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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 2 JULY, 1925 NUMBER 1

BRAIN TUMOR *

NEURO-OTOLOGIC EXAMINATION IN SEVEN CONSECUTIVE VERIFIED CASES IN THE POSTERIOR FOSSA IN CHILDREN *

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TORONTO

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In March, 1923, I [1] presented a study of the data discovered in the neuro-otologic examination of eleven verified cases of brain tumor observed at the Massachusetts General Hospital. From these, certain conclusions were drawn.

Since that time the same subject of investigation has been pursued at the Hospital for Sick Children, Toronto. In the last two and a half years, many children have undergone neuro-otologic examination, but in only twelve cases has my examination suggested the presence of an intracranial lesion. Five of these have not come to proof. The seven which have been proved are fully described in this paper.

The cases are presented in the same manner as were those in my earlier paper. Unessential details are omitted, but the clinical records of the seven cases are given in sufficiently complete detail to enable otologists and neuro-otologists to study them intensively.

INTRODUCTION

In the earlier paper, I ventured to draw three generalizations from the study of the cases:

1. The tumors of the frontal lobes did not interfere with cochlear or vestibular function. (Tumors intermediate between frontal lobe and cerebellum are not considered in either of these communications, because such have not entered into my consideration in this aid to the localization of intracranial tumors.)

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* Read before the American Otological Society, Washington, D. C., May 4, 1925.

1. Wishart, D. E. S.: J. Laryngol. & Otol. **38**:109 (March) 1923.

2. The extracerebellar tumors affected homolateral, cochlear and vestibular function.

3. Intracerebellar tumors did not interfere with cochlear function but interfered with vestibular function. The latter was affected more or less according to the size and situation of the growth; but the interference tended to be bilaterally symmetrical, and the functions of both vertical canal reflex arcs were affected before those of the horizontal canals.

The present series contains no proved case of supratentorial tumor. I have made the diagnosis of one supratentorial lesion, but the results in this case have not yet been proved. The first generalization may therefore stand without further comment.

My observations on these later cases would seem to prove that the second generalization must be modified. In the earlier paper, the term "extracerebellar" referred to two tumors of the eighth nerve and to one unilateral tumor of the pons. In the present series there are no cases of tumor of the eighth nerve, and no case of unilateral pontile lesion. But there are three cases of massive tumor concealed by the contents of the posterior fossa which did not invade cerebellar tissue itself and therefore are extracerebellar. The trouble is not with the idea embodied in the generalization—the difficulty lies in one word only—the word extracerebellar. These cases will be carefully presented and the generalization re-stated more exactly.

The third generalization should perhaps also be modified in view of the facts presented by this new series.

The data presented here may be sufficient to redraft these generalizations and to add others of distinct otologic value.

REPORT OF CASES

CASE 1.—*Tumor of the Cerebellum.*—W. L., a boy, white, aged 7½ years, was admitted to hospital Dec. 23, 1922, for observation, with headache, loss of appetite, intermittent vomiting and irritable disposition of two months' duration.

History.—The history and condition of the patient were described by Dr. George F. Boyer as follows: "The father states that the child has always been healthy. During the last two or three years, however, the child developed an occasional enuresis. The father states that on October 8, several children were playing in a barn and the patient attempted to jump at a rope which reached to the floor about 10 feet below. The rope broke and the boy fell on a pile of rags, but in doing so hit his head on some hard substance, whereupon his playmates ran away and left him. He apparently was knocked senseless. At a later period, the exact time of which is not known, he was lifted from the pile of rags and was taken in a wheelbarrow to the street in front. He was then conscious, walked home, ate his evening meal, went to his class in Hebrew that evening, but did not do well at his lessons. Nothing was known of the accident by the parents during this time. The child went to bed and woke up at night stating that things were going round and that he had had a bad fall the afternoon before.

"The following morning Dr. Henry MacKendrick of Galt was called to examine the boy, but he found no signs of external or of internal injury. There was no mark on the back of the head. The father thinks that he fell on the occiput.

"There is no definite history of complaint from this date until about the beginning of December, but the child did not make as good progress in school as previously. His teacher complained that there were more mistakes in his work. About November 15, it was noticed that the pupils of the eyes had become larger, and at intervals the boy complained of headache. By December 1, his gait was becoming unsteady. He was obviously not as quick mentally, his head had begun to incline to the left (father not sure) and unsteadiness had developed in the hands. At this time he was given some medicine by Dr. MacKendrick, and the father insisted that the vomiting which the boy developed then was due to this medicine. Since then he has not complained so much of headache, unless he has been asked specifically about it, when he admits some pain and described it as more in the occipital region. During this period it is to be noted that the father insisted that the child walked well, ran well, showed no symptoms from the date of his fall until about the commencement of December, and had it not been for the remarks of his teachers, combined with the enlarged pupils and the occasional headaches, no particular notice would have been taken of him except for the development of subsequent symptoms.

"The patient reported at my office some three or four days ago. At that time he had been up all day and was obviously tired. Cerebration was slow. Cooperation was good and he would attempt to answer any question put to him, which showed that his intelligence was of normal development. He walked with a wide base, stood with the feet at least a foot apart, the head was inclined to the left shoulder and turned slightly to the left, the face lacked keen expression and occasionally well marked weakness of the right side of the face would be seen. The tongue protruded slightly to the right. The pupils were unequal, the right being larger than the left, but both reacted to light. His speech was definitely slurred. I could demonstrate no ocular paralysis, although there was a coarse nystagmus in all directions, both horizontal and vertical; the nystagmus was characterized on looking to the left with the fast movements outward and the slow movements inward; on looking to the right, the fast movements were inward and the slow movements were outward. On examination of the optic disks there was no blurring whatever in outline, the retinal veins were full but not to a degree that could be called pathologic. He could hear well with either ear and he felt a pinprick on face, chest, arms and legs. Corneal reflexes were present. Deep reflexes of the arms were about equal and were rather difficult to obtain. The knee jerk on the right side was of greater extent than on the left and the same applied to the ankle jerks but to a less marked degree. Plantar responses on the left were flexor, on the right they were occasionally extensor but not of characteristic Babinski type. The abdominal reflexes were not obtained. The bladder and bowel control were normal.

"On lying in bed, no apparent disabilities of the arms and legs were evident. The grip of the right hand was not quite so strong as the grip of the left hand. On being asked to move either arm, the boy showed coarse ataxia; this was noted on volition and when asked to maintain a definite position — that is, he showed a static defect. It was not aggravated to any marked extent by closing the eyes. When asked to maintain one position with the right arm at the same level as the left, the right gradually sagged until it maintained a position several inches below that of the left, showing a well marked atony. The same signs of ataxia were present in the legs but not to the same degree. Since his stay in hospital, most of these observations have been corroborated from time to time. On two occasions on waking he has had projectile vomiting on sitting upright in bed. His fields of vision are full. The ataxia, best shown in the right upper limb, is of a coarse, irregular arrhythmic type.

"The patient shows a well marked dysdiadokokinesia, more marked on the right side but present on the left. He shows well marked 'rebound phenomena' on both sides but more on the right side, that is, the right triceps does not inhibit the activated biceps fully. Roentgenograms of the skull show no fracture nor widening of the sutures.

"It is my opinion that this patient has a subtentorial lesion of the cerebellum involving the lateral lobes, more especially the right lateral lobe. The nature of this is not known. The history points to traumatic causes with cystic formation; tumor may be present. The lesion is probably forward in the posterior fossa because of the weakness of the right side of the face.

"Recommendation.—I recommend suboccipital decompression."

The first otologic examination was made Jan. 4, 1922. The child previously had been examined Dec. 29 and 31, 1921, and Jan. 2, 1922. This report covers constant findings which are not repeated.

Spontaneous Phenomena.—1. The patient was oriented, intelligent and cooperated well; from time to time during examination he sobbed uncontrollably. Articulation was slightly impaired, also movement of the lower part of the right side of the face; during periods of sobbing, articulation became much impaired, speech became slow, jerky and indistinct and the weakness of the lower part of the right side of the face was evident. The boy was left-handed (?), he wrote with the right hand but said he threw a ball with the left hand. 2. The tongue was larger on the right than on left but did not deviate on being protruded. 3. No objective abnormality of the throat was noted except that of articulation. Movement of the right side of the palate seemed slightly less than of the left. 4. The larynx was not seen properly. 5. Both ear drums were normal, the hearing was good, no impairment of hearing for either ear had been demonstrated. 6. Coordination: (*a*) the gait was somewhat stumbling and unsteady, the boy did walk with wide base on any of the four dates examined; there was a slight tendency to deviate to right. (*b*) The Romberg sign was present; the boy swayed and tended to fall backward and to the right; alteration of the position of the head did not alter the direction of falling. (*c*) He stood on one leg with great difficulty, less well on the right than on left. (*d*) The arms and hands showed marked ataxia, which was increased by rapid movement; the right arm could not be moved as fast nor as accurately as the left. (*e*) Pointing was uncertain with both arms but there was a definite tendency for both arms to past-point to the right. 7. Strength: The movements of the right arm and the right leg were much weaker than those of the left arm and leg. 8. Eyes: (*a*) Reacted to light and in accommodation. (*b*) There was no optic neuritis. (*c*) They could move in all directions. (*d*) Nystagmus was present when the eyes moved to the right or left, up or down, but not in looking ahead. The quick component was in the direction toward which the eyes were turned. (*e*) On right deviation, the nystagmus was slow and wide, horizontal in type. (*f*) On left deviation the nystagmus was much faster and was a mixture of rotary and horizontal.

Induced Phenomena.—Caloric tests were made with water at 66 F. on Dec. 29, 1921.

Left ear, with the head 30 degrees forward: 1. After thirty seconds, there was a slight nystagmus when looking straight ahead. The douching was continued for two and a half minutes without any discomfort or dizziness. The nystagmus was then rotary to the right, of second degree and of slight grade only. 2. Past-pointing: Right arm to left; left arm to right, with the head 60 degrees back. 3. There was a definite wide horizontal nystagmus to the right. 4. No past-pointing.

Right ear, with the head 30 degrees forward: 1. The patient quickly objected and complained of ear pain. Douching did not last more than fifteen seconds but there was prompt definite rotary nystagmus to the left. 2. Past-pointing could not be investigated. With the head 60 degrees back: 3. Definite wide horizontal nystagmus to the left.

Jan. 2, 1923, the cold air caloric test was made.

Left ear, with the head 30 degrees forward: 1. Ocular response was delayed and slight. With the head 60 degrees back: 2. Ocular response was very marked and of normal type.

Right ear, with the head 30 degrees forward: 1. There was sudden objection and the test was unsatisfactory but the ocular response was prompt, definite and of normal type. With the head 60 degrees back: 2. Ocular response was normal.

January 4, caloric tests were made with water at 62 F.

Right ear, with the head 30 degrees forward: 1. The right ear was very irritable, second degree rotary after-nystagmus to the left was present, which was definite after thirty-five seconds. 2. Past-pointing: both arms to right, slightly more than spontaneously. With the head 60 degrees back: 3. There was second degree horizontal nystagmus to the left. 4. Past-pointing: Both arms were wide to the right. The patient was slightly dizzy but there was no nausea or pallor.

Left ear, with the head 30 degrees forward: 1. This was douched for three minutes before a slight rotary nystagmus to right in looking ahead position was noted. 2. Past-pointing: Right arm second to right; left arm, touched or to right. With the head 60 degrees back: 3. There was wide horizontal nystagmus to the right. 4. Left arm touched; right arm to left. No nausea, pallor or vomiting were present at any time.

Summary.—This was a difficult case to handle. The presence of the spontaneous nystagmus made nystagmus in the looking ahead position the only inducible ocular phenomenon. The spontaneous ataxia of the arms made accurate observation of the induced past-pointing almost impossible. 1. There was no impairment of hearing. 2. Ataxia of the arms and legs was present. 3. The ocular response from both sets of canals of both ears was normal. 4. The stimulation of the right ear has constantly produced a prompt response and evidently irritated the patient very much. 5. The rotary ocular response from stimulation of the left ear was of normal type but was much delayed. 6. Incoordination of movements of the arms with fairly constant spontaneous past-pointing to right were observed. 7. The left arm movements were very little altered by stimulation of either ear. 8. The ataxia of the right arm was increased by the stimulation but its spontaneous past-pointing error was altered only by stimulation of the left horizontal canal. 9. No suggestion of pallor, nausea or vomiting, were noted, even after prolonged douching.

Impression.—There was no peripheral lesion of the vestibular or the cochlear portion of either eighth nerve. There was an organic intracranial subtentorial lesion affecting the right side more than left.

Operation.—Dr. W. E. Gallie performed a cerebellar decompression and explored the cerebellum on January 9. No indication of tumor, abscess, or anything of the sort could be found.

Progress.—The patient was given high voltage radiation, 400,000 volts for 200 minutes, 0.75 mm. of copper filter at 16-inch distance. February 18, the boy was discharged home.

Interim History.—April 1, Dr. Boyer reported: "The boy walked into the office today without difficulty. He hops on each foot but better on the right. He runs and hops. There is no slurring of speech. He reads well and writes with the right hand. No horizontal nystagmus. Optic disks normal. No static ataxia. No atonia is present. This boy is practically well."

Second Admission.—The patient was admitted to hospital again from May 20 to June 2.

Condition.—Dr. Boyer described the patient as follows: "About twelve days ago, the parents noticed that the child was becoming more unruly, obstinate and impulsive. Today he showed poor attention, and was easily dissociated. There

was some general mental impairment but not in any specific field of investigation. For instance, he does not count or spell accurately or do a small addition as accurately as previously.

"He sits in bed with the head forward, inclined and turned slightly to the right. He walks spastically, more so on the right foot, with the right arm adducted and flexed on the groin. In walking, the head is swung more forward into the middle line but still bent forward and inclined slightly to the right. In standing with the eyes closed, his swaying has a marked tendency backward and more to the right than to the left. On walking with the eyes open, he varies in direction of right, but with the eyes closed he goes much more to the left. Walking backward with the eyes closed, he continuously tends to the right.

"The occipital cerebral hernia is firm in consistency and transmits light only to a small degree in a small upper segment. The boy hears with either ear. He sees fingers well at a distance of 10 feet with either eye. The optic disks are perfectly normal. There is no sign of undue pressure in the retinal vessels. On lying down, the boy keeps the head poked forward and complains of dizziness when he lets it fall back. The right pupil is larger (5 mm.) than the left (4 mm.). Both react to light and react well consensually, are regular and concentric. On looking to the left, the patient has a coarse nystagmus with marked rotary component. On looking to the right, he has nystagmus with the fast component outward, very slight rotary factors. He has a vertical nystagmus. The fields of vision are full. His speech is slow and has a definite slurring character. The right side of the face is weak. Both corneal reflexes are present and equal. The tongue shows a coarse irregular contraction and goes slightly to the right. The palate is equally innervated. At rest, the limbs show no marked change in position. On movement and manipulation, the right wrist appears to have less tone than the left, but the left calf and ankle show more passive movement than the right, while passive flexion of the right thigh and manipulation has larger range of movement than the left. Movements of the right arm and right leg have a coarse ataxia of the cerebellar type. The same ataxia is present on the left to a much less marked degree. The extended pointing finger on each side shows this ataxia but it is much more marked on the right side, as the right gradually seeks a lower position. The same condition is present in the pointing toe. There is more strength in the grip of the left hand. The right arm and leg movements have not got as much power. Deep reflexes (upper limb) show more response on the right side. The right knee jerk is distinctly faster and greater than the left. The right ankle jerk is greater than the left. The right plantar response is definitely extensor with hamstring withdrawal. The left is flexor. Abdominal reflexes are present on the left and absent on the right.

"May 26, the patient cannot hold a pencil well enough to write.

"Opinion.—An infiltrating cerebellar glioma is present on both sides, more marked on the right side but also present in the left. Undoubtedly with these there is cystic formation which has decreased.

"Recommendation.—I would recommend a second operation in the hope that this condition can be found. Without this, I see very little chance of this boy's life. Later, high voltage radiation should be considered."

Treatment.—On May 28, the boy had 28 minutes exposure to 200,000 volts of the roentgen-ray.

Third Admission.—The boy was again admitted to hospital from August 27, to October 1.

The boy should have returned for roentgen-ray treatment on July 28, but he was doing so well that Dr. Boyer advised waiting another month. About August 20, the boy began to lose control of the right arm and leg again. The right leg was then so weak that he fell over frequently.

Otologic Examination.—Second Examination: August 28.

Spontaneous Phenomena.—1. Horizontal nystagmus on looking to the right, left and up; none on looking ahead. 2. Ataxia and asymmetry of arms, forearms and hands and dysarthria more marked than on last examination; ataxia on the right was greater than the left. 3. The ear drums were negative. 4. Emotional disturbance was very easily produced.

Induced Phenomena.—The left ear was douched with cold water for about thirty-five seconds, the patient was upset and would not cooperate. There were confused irregular nystagmic movements, and a quick component to the right. When the patient lay on his back, there was definite wide horizontal nystagmus, quick to the right. As the patient would not cooperate, no further examination was made.

Impression.—There was no lesion of the left eighth nerve; there was no impairment of reflex-arc to the eyes from the horizontal canals. Slight impairment of reflex-arc to eyes from vertical canals was present.

Treatment.—September 4, the left parieto-occipital region was exposed to 200,000 volts for twenty-one minutes.

Condition.—September 8, Dr. Boyer described the condition as follows:

"About two weeks ago this patient began to develop ataxia again, which rapidly became worse. About one week ago, he developed a loss of speech and difficulty in swallowing. Today he is unable to speak, protrudes his tongue; there is double facial weakness with distinct impairment of the lateral and vertical movements of his eyes. He can move both arms and hands but slowly. He can move the left arm and lower limb better than the right. The right lower limb is nearly paralyzed.

"His intellect is clear. He understands spoken English and sees without definite disability. He makes known his wants by pointing at objects or by selecting the right name from a group of words. He hears with either ear. The optic disks do not show any signs of being changed by intracranial pressure. The deep reflexes of the upper and lower limbs are all pathologically increased; he has lost the abdominal reflex, and the plantar reflex on the right side gives a more marked Babinski than on the left.

"The tumor in the occiput has increased in size to a slight degree and transmits light in its upper half. He feels a pin readily in the arms and legs. At present he is receiving high voltage roentgen-ray treatment over the side of the cerebellum, which has caused improvement on former occasions, but at the present time, the invasion of the pons is so serious that it is questionable if any further benefit can be derived. He has lost the power of speech and most of the function of swallowing.

"October 1, the boy was transferred home. He was unable to walk, the right arm was spastic and there was marked facial weakness."

Fourth Admission.—The boy was again admitted to hospital from October 16 to October 19.

Condition.—Dr. Boyer described the condition as follows:

"The patient's intellect is good. He cannot speak. He hears with either ear. He cannot protrude the tongue farther than just past his incisor teeth. The right side of the face is paralyzed. There is slight weakness of the left external rectus of the eye. He feels a pin on both sides of the face. His pupils are slightly unequal and are dilated. The right arm is in position of spastic flexion and he has only slow voluntary and slight movement. The left arm is fairly free in movement. His legs are in a position of extensor spasticity; the reflexes easier obtained on the left side but both pathologically increased. There is a double Babinski sign present.

"*Consultation and Opinion.*—Prof. Alexander McPhedran saw this patient with me today, and he is of the opinion that the anterior surface of the right cerebellum should be investigated. He is also of the opinion that the patient has a diffuse intracerebellar tumor, probably gliomatous, but that operation offers the only chance left of any help."

Operation.—October 17, Dr. Gallie explored the cerebellum. About 40 c.c. of clear fluid was removed by ventricular puncture. This considerably reduced the bulging in the occipital region. An attempt was made to free the scalp from the hernia in the occipital region, but in doing so loculated cysts containing clear fluid were opened. A large loculus on the right continued into a dark, friable, fairly firm mass which seemed to go down into the vermis. A section of the dark mass was removed for histologic examination. On the left side the tumor mass was fairly diffuse and seemed to spread out into the cerebellum. The right cerebellopontile angle was thoroughly examined but nothing abnormal was found.

Progress.—Two days later the boy died. Permission for necropsy was not obtained. The sections removed at operation were reported as showing only chronic inflammation of cerebellar tissue.

CASE 2.—*Glioma of Cerebellum.*—H. K., a girl, white, aged 7 years, was admitted on March 14, 1923, with the diagnosis of cerebellar tumor. The chief symptoms were pain at the back of the neck, headache and vomiting, occurring intermittently for five months, and a squint of six weeks' duration.

History.—The child was perfectly well until October, 1922, when she began to have occasional pains in the back of the neck which would last for a few minutes and then disappear. The child would seem quite well for a week or two and then have another sharp pain in the back of the neck. Almost from the first she vomited at the time of these pains and complained of headache. In the intervals of from one to two weeks, there were no symptoms. About Feb. 1, 1923, the parents first noticed that one eye was turned in and the squint has since been present continuously. It seemed more noticeable when the child was tired. At the time the eyes went wrong, the child had a tendency to stumble and fall to the right when tired. On February 26, the child was brought to Toronto and a diagnosis of cerebellar tumor was made by Dr. R. G. Armour. The patient was later seen by Dr. Goldwin Howland.

Condition on Admission.—A well developed, well nourished girl, aged 7 or 8 years, not acutely ill, was seen. The general condition was normal except for the findings detailed in the following special reports.

Eye Examination (Dr. W. H. Lowry).—"March 16, the child has well marked optic neuritis in each eye with considerable swelling of disk and no hemorrhage. The left disk is more swollen than the right. The optic neuritis has increased considerably since my examination a couple of weeks ago.

"The child has a diplopia due to a weakness of the left external rectus. This varies in extent; sometimes the squint is more obvious. The vision is still good. No paralysis of accommodation is present.

"If any operation is contemplated, it had better be done immediately as the neuritis is increasing and I fear for the nutrition of the nerve."

Neurologic Examination (Dr. Boyer).—"March 16, the child is mentally bright, is fairly intelligent and is not unduly disturbed. She answers questions, obeys commands and cooperates well during examination.

"At rest, her right eye is turned in, while the left eye is nearly in the anteroposterior position. She does not complain of pain in the neck, forehead, arms or legs, either at rest or on manipulation.

"Her station when standing is steady and is well maintained without swaying, although her feet are placed somewhat wide apart (about 8 inches). She walks without obvious spasticity or paralysis. She walks fairly well in a straight line as long as her eyes are open. In walking backward, she tends first to one side and then to the other. There is no consistency as to which side. Standing with the eyes closed, she tends backward, but it is quite possible to correct this although she has a backward swaying motion. With the eyes closed and with the pointed finger extended, she tends to miss the mark by about 8 to 10 inches to the right side with the right hand extended and to the left side with the left hand extended. This, however, is not constant.

She has a well demonstrable Macewen's sign on percussion of the head. Her hearing is equal and does not show any decrease in acuity to gross tests. The pupils of the eyes are large, equal and react to light. The squint she has is not of a paralytic type, for by covering the left eye she has full range of movement of the right eye and the same with the left eye, but there is questionable weakness in the left external rectus. There is no nystagmus in any direction. There is no narrowing of the fields of vision to gross tests. There is well marked double choked disk, which is slightly more marked on the left side. If there is any difference in her vision at present, it does not show much decrease in acuity in either eye for she describes intricate finger movements without apparent defect of sight. There would appear to be equal power in the palatal muscles but the palatal reflex is not so active as in a normal child. The tongue is deviated slightly to the right.

"At rest, her arms and legs show no motor change. The hand grip on the right side is not noticeably weaker or different from the left, except that it is not as well maintained. The deep reflexes of the upper limbs are present and equal. The abdominal reflexes of the upper limbs are present and equal. The abdominal reflexes are present on either side but are less active on the left. The knee jerks are easily obtained, but have a quicker reaction on the left. The ankle jerks are present; no clonus; and plantar reflexes are flexor. On extending the hands, fingers and arms, the right upper arm shows some static ataxia and gradually assumes a lower position than the left, which intermittently is corrected by sight perception of its position. The same is present in the legs. The right arm movements are a little slower and more incoordinate than the left and the patient shows a well marked dysdiadokokinesia on the right side. There are no sensory changes to touch or pin demonstrable in the face, trunk and limbs. Diagnosis: Cerebellar tumor.

"There are no signs of this condition being above the tentorium. There is evident indication of intense intracranial pressure probably occluding the exit of the fluid from the ventricular system. I feel that the tumor involves the right side of the cerebellum more than the left, or at least is slightly more in a forward position on this side. It is my opinion that a suboccipital decompression should be undertaken at once. The nature of the growth should be determined on the blood, tuberculin, Wassermann and cerebrospinal fluid examinations and the results of these are not available at present."

Otologic Examination.—The first examination was made March 16.

Spontaneous Phenomena.—1. Ears: There was no history of ear trouble at at any time, the ear drums were practically normal; there was no demonstrable impairment of tone range, of air, or of bone conduction in either ear. 2. The eyes were steady when looking ahead, up, or down; there was weakness of the left internal rectus; on left deviation of eyes, there were some nystagmoid jerks in each eye which was more marked in the left eye. 3. The general condition was good, intelligent and oriented; the child responded readily and willingly; apart from the squint she looked normal and healthy. 4. The gait was unsteady, there was a questionable deviation to the left; the child stood poorly on one foot; the awkwardness was possibly greater on the left; the right leg moved more awkwardly than the left. 5. Arm coordination with rapid movement showed awkwardness of both arms; past-pointing, the right arm wabbled but touched; the left arm past-pointed constantly to the right 4, 3 and 2 inches. 6. When the head was put back 60 degrees, there was no change in nystagmus or past-pointing. 7. The Romberg test showed swaying and uncertain direction.

Induced Phenomena.—Caloric test with the water at 66 F., showed left ear, with the head 30 degrees forward: 1. The ear was douched for five minutes, no nystagmus was produced. 2. Past-pointing was unchanged. 3. There were no discomfort, dizziness, nausea or vomiting. With the head 60 degrees back: 4. No nystagmus was present. 5. Past-pointing was unchanged. 6. (Same as No. 3.)

Right ear, with the head 30 degrees forward: 1. The ear was douched for five minutes; at times there seemed to be a slight rotary after-nystagmus to the left, but it was uncertain and certainly not present at the end. 2. Past-pointing was unchanged. 3. There were no discomfort, dizziness, nausea or vomiting. With the head 60 degrees back: 4. Definite wide horizonal after-nystagmus, quick component to the left was noted. 5. Past-pointing was spontaneous, slightly changed with a tendency to the left. 6. A slight sensation of rotation of objects was present.

Summary.—1. Normal middle ears. 2. Normal hearing. 3. Squint. 4. Ataxia and asynergy of both arms and legs, seemingly more marked in the limbs of right side. 5. Questionable weakness of right arm as compared with left. 6. Prolonged stimulation of left semicircular canals produced: (*a*) no ocular-response; (*b*) no change in the past-pointing; (*c*) no discomfort, no nausea and no vomiting. 7. Prolonged stimulation of right vertical semicircular canals produced: (*a*) no ocular response; (*b*) no certain change in past-pointing; (*c*) no discomfort, nausea or vomiting. 8. Short stimulation of right horizontal canals produced: (*a*) normal ocular response; (*b*) questionable change in past-pointing; (*c*) sense of some dizziness; (*d*) neither nausea nor vomiting.

Impression.—Organic intracerebellar lesion involving the left side chiefly.

The second examination was made March 17, and the foregoing tests were confirmed.

The third examination was made March 18.

Induced Phenomena.—Both ears were stimulated by water at 66 F., with the head in 60 degrees position. Left ear: 1. No ocular response. 2. No past-pointing response.

Right ear: 1. Well marked horizontal after-nystagmus to the left appeared after thirty-five seconds. 2. Past-pointing unchanged.

Caloric test, water at 66 degrees F. Left ear: No response of any kind after douching for five minutes.

Right ear: Douching carried on for five minutes with head 30 degrees forward. 1. Definite but irregular rotary after-nystagmus to left, of second grade. 2. Past-pointing unchanged. 3. No nausea. With the head 60 degrees back: 4. Well marked horizontal after-nystagmus to the left. 5. Past-pointing right arm, swung first to right, then touched, left arm the same, as spontaneously.

Summary of New Findings.—1. Right horizontal canal; ocular response appears in normal time. 2. Greatly delayed, but present, ocular response from the right vertical canals.

Impression.—The pressure in the posterior fossa is slightly less than on previous examination, allowing stimulation of right vertical canals to produce a response of the normal type, although of diminished degree. This indicates that the lesion is essentially on the left side.

Roentgen-Ray Examination.—The skull showed some general atrophy and considerable opening up of the coronal suture, which was evidence of marked intracranial pressure. Lamboid suture appeared normal. The condition suggested a subtentorial tumor.

Operation.—On March 20, Dr. Gallie performed a suboccipital decompression. After the bone had been removed, it was found that the cerebellum was under a great deal of tension, more marked on the left side. Over the left cerebellar hemisphere just to the left of the falx cerebelli there was a white surface about one-fourth by one-half inches in size, which appeared slightly more tense than the surrounding surface. The dura mater over the cerebellar hemisphere was then incised crucially on either side of the falx cerebelli, and on lifting it up from the underlying cerebellar hemisphere with a spatula, a large quantity of cerebrospinal fluid escaped and following this the tenseness of the bulging brain was greatly relieved. It was found after the pressure had been relieved that a soft spot, much less tense than the brain surrounding it, was present at the point where the white spot had appeared on the surface

before the dura mater was incised; it was thought probable that the lesion had been a cerebellar cyst and that this was the cause of the symptoms. As no evidence of any other pathologic condition could be determined, it was decided to do nothing further.

The patient died on March 26.

Postmortem Examination.—The entire brain was removed for examination. No abnormality was discovered in the cerebrum. A large tumor mass, part of which had undergone cystic degeneration was discovered to occupy almost the whole of the right half of the cerebellum.

Figure 1 shows a sagittal section of the whole brain. The disproportion of the two halves of the cerebellum is well demonstrated, also the location of the cystic portion of the tumor. It also shows how a portion of the cyst had extended to the left side.

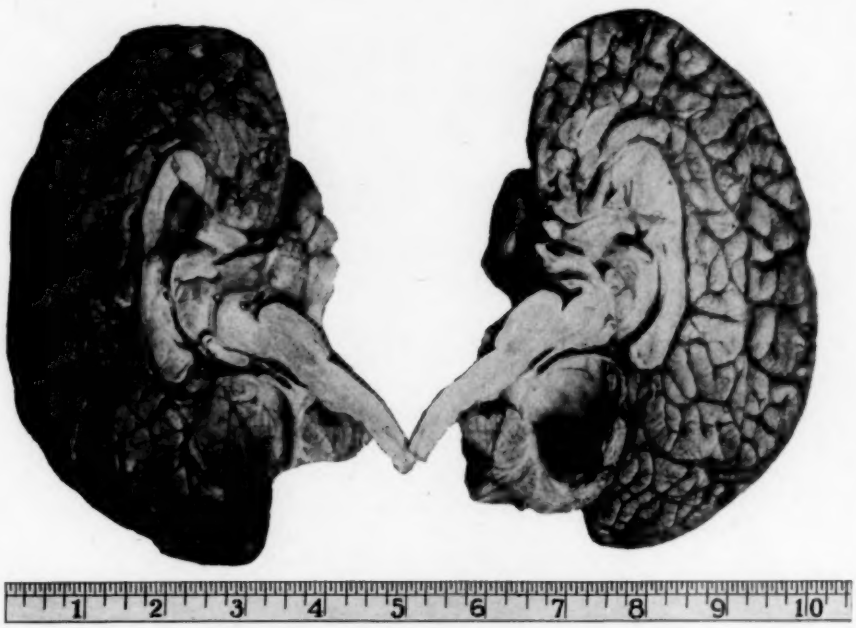

Fig. 1 (Case 2).—Sagittal section of whole brain, showing tumor of right half of cerebellum.

Figure 2 is a view of the superior surface of the cerebellum. The solid part of the tumor is seen to occupy the posterior part of the degenerated area of the cerebellum. In front of it can be seen the part which had undergone cystic degeneration. This portion had a very thin roof which was ruptured at the necropsy.

Figure 3 is a view of the posterior face of the frontal section through the cerebellum showing the tumor mass. This photograph was taken with the cerebral hemispheres in place. The left half of the cerebellum has been sectioned about one-half inch further forward than the right half. In the left half of the cerebellum, which is seen to be about half the size of the right hemisphere, the cortical substance and the medullary body are well differentiated and appear normal. In the right half, however, these two constituents can be differentiated only at the lateral periphery: in the remainder, the two

portions have been blotted out, or replaced by a nearly homogeneous, firm substance, which shows some resemblance to the white matter.

Histologic Diagnosis.—Glioma of cerebellum with cystic degeneration.

CASE 3.—*Papilloma of the Choroid Plexus of the Fourth Ventricle.*—D. B., a boy, white, aged 6 years, was admitted to the hospital April 30, 1923, with a history of vomiting for the previous two months.

Fig. 2 (Case 2).—The superior surface of cerebellum.

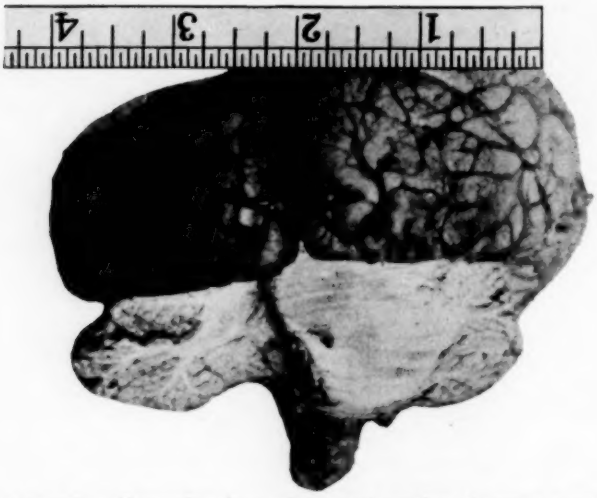

Fig. 3 (Case 2).—Posterior face of frontal section through cerebellum.

History.—The boy was quite well up to February 24, when he vomited after eating an orange. The vomiting continued and occurred from one to four times daily and was never projectile. The bowels were markedly constipated. The child became steadily weaker.

Condition.—Dr. Boyer's examination on May 8 was as follows: "The child's mentality is good. He answers questions readily without confusion or undue emotion. He lies in bed with his head turned to the right and he states that it makes him dizzy to move his head to the left. His general emaciation is marked. He can sit up but still maintains his head turned to the right and inclined slightly to the right.

"He has no loss of voluntary power, except occasionally the left side of the face may not be quite as well innervated to motion as the right. He has nystagmus on looking to the left with the fast component to the left. He has a slight but less constant nystagmus on looking to the right. His tongue and throat are equally innervated. He hears with either ear. His speech is normal. His deep reflexes are difficult to obtain, but can be obtained at times and are probably decreased on account of his general emaciation. The plantar and abdominal reflexes are normal and equal. He has no tremor in hands or legs. There is slight coarse static ataxia in the left hand and

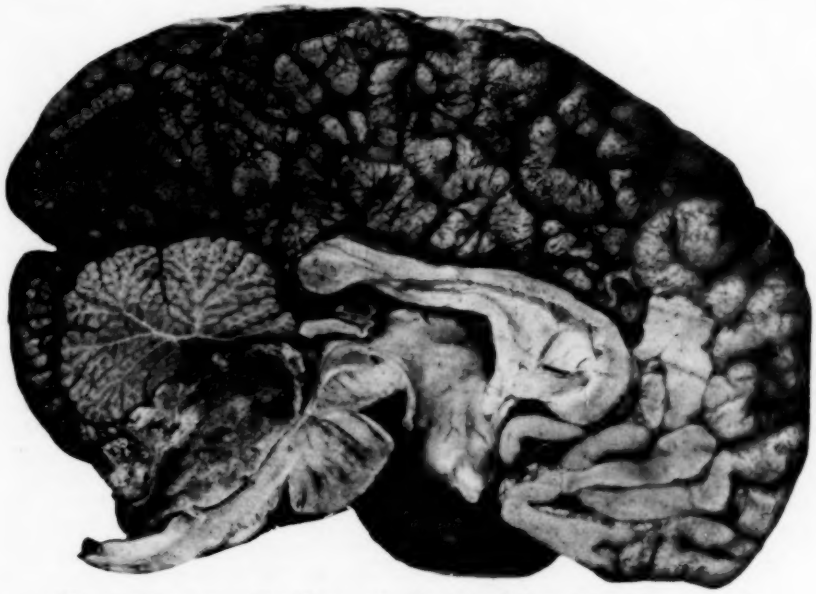

Fig. 4 (Case 3).—Papilloma of choroid plexus of fourth ventricle.

leg, and they tire slightly more easily than the right. This is, however, slight and should not be taken as more than suggestive of unilateral value. The pupils are dilated (atropine). The optic disks are not equal, as the disk margins and the vessels of the right are slightly more indefinite and tortuous than on the left. On sitting up, he complains of headache in the frontal region. He has a high forehead with a broad upper part of the head and the antero-posterior diameter is long. Macewen's sign is also definite.

"Opinion.—It is my opinion that this patient has an intracranial neoplasm or inflammatory condition probably involving the cerebellum but not endangering the optic disks at this time.

"Recommendation.—I would recommend that for one week he be put on mercury and iodid."

Laboratory Findings.—The Wassermann blood and cerebrospinal fluid tests were negative. All tuberculin tests were negative. The cerebrospinal fluid was sterile.

Roentgen-Ray Examination.—This showed nothing abnormal in the skull except what appeared to be a rather deep venous fossa on inner table of the skull in the upper right frontal region.

Otologic Examination.—This was made May 9.

The whole examination was made with the boy recumbent, lying slightly on the right side with the head turned to the right.

Spontaneous Phenomena.—1. A marked grade of wide spontaneous nystagmus of horizontal type, quick component to the right, was not present when the eyes were turned slightly to the left of the midline; a faint rapid nystagmus, quick component to left, at times when the eyes were turned far to the left. The nystagmus remained horizontal when the eyes were turned up. 2. Both canals were found to have brown débris obscuring the drums; after this was removed, the right drum appeared normal, the left one was injected in its posterior half and showed a healed scar. Both were difficult to see. 3. In both ears, the patient appeared to hear the whole tone scale by air conduction; he heard a watch at 2 feet with the left ear and at 1 foot with the right ear.

Induced Phenomena.—Both ears were douched with cold dry air. 1. There was a normal ocular response in each case; namely, when the head was in the 60 degrees position with the face upward, there was a definite second grade horizontal nystagmus with quick component to the opposite side. 2. In order to avoid annoying the child, he was not raised to the 30 degrees forward position but the head was turned toward the pillow. In each case, this should have resulted in a rotary movement of the eyes, but none was detected.

Summary.—1. A normal ocular response in both ears was present. 2. There was a normal ocular response from stimulation of each horizontal canal. 3. There was a possibly impaired ocular response from stimulation of each vertical canal. Of this I would not be certain unless the test could be repeated.

Impression.—1. Healed otitis media, left ear. 2. No peripheral lesion of either eighth nerve. 3. No evidence of lesion in either cerebellopontile angle. 4. The picture was that of increased intracranial pressure chiefly in the posterior fossa.

Progress.—The next day the child died suddenly.

Postmortem Examination.—Brain: The calvarium was removed in the usual manner. This appeared normal, except that there was a small area about 1.5 cm. in diameter just to the right of the midline in the frontal region, in which the bone was quite thin. The brain appeared to be under a moderate degree of tension; the meningeal vessels were markedly congested and the cerebral cortex was slightly edematous. There was a tumor in the fourth ventricle (Fig. 4), roughly about the size and shape of a hen's egg, measuring 4.5 cm. in length, 2 cm. in depth and 3 cm. in width. It extended somewhat further toward the left than toward the right side. The tumor appeared to be growing from the inferior portion of the roof of the fourth ventricle (the tela choroidea), and while it lay on the floor of the fourth ventricle it was not adherent to the medulla except for a narrow band toward the inferior pole. Superiorly, it was covered by the cerebellum, which it had pushed upward and posteriorly, but had not invaded. On section, it cut for the most part with ordinary resistance, but at several points the knife encountered gritty material. The cut surface was rather granular and grayish red, as though the tissues were rather vascular. The tumor appeared to have caused some obstruction to the circulation of the cerebrospinal fluid, as there was some dilation of the aqueduct of Sylvius and both lateral and third ventricles.

Histologic Diagnosis.—Papilloma of choroid plexus.

CASE 4.—*Gliomatous Cyst of Cerebellum.*—M. G., a girl, white, aged 7 years, was admitted to the hospital on May 19, 1923, with a history of vomiting and headache of two years' duration, and of restlessness and screaming at night for over a year.

History.—The child was perfectly well until she developed whooping cough in April, 1921. Frequent headaches and attacks of vomiting commenced with the whooping cough and persisted off and on ever since. For the first six months, the vomiting would occur about once a month. Then the parents noticed that the child seemed to walk with her feet farther apart than formerly, and the vomiting began to occur more frequently, increasing to twice a month and then once a week. In January, 1922, the child had to stop going to school because the vomiting spells were occurring more frequently. The attacks usually commenced about midnight, the child becoming very restless in bed. With her head drawn back, her extremities cold, she would complain of headache or would scream out in her sleep. The attack would last most of the night. At times the child would be unconscious, would pass feces and urine involuntarily. Toward morning the child would become nauseated, would vomit, sleep and then get up and move about. The usual attack left the patient quite worn out. During the attack there would be no twitching of the body and no frothing at the mouth. The vomiting and night attacks continued to become worse.

In February, 1922, a physician stated that the child had choked disks. In March and again in May, brain tumor or cyst was diagnosed. On the latter date, the child could not sit up or walk and would fall off a chair. In June the vomiting ceased entirely, although the headache persisted, and the walking improved. The night spells ceased and did not reappear until February, 1923. After a period during which all the symptoms reappeared, there was a short period of quiesence, but the vomiting and night spells reappeared and then continued for the three weeks prior to admission.

Condition.—The following is Dr. Boyer's description of the case:

"The child lies in bed in a position of ease. She is talkative, emotional and impulsive. She is oriented quickly as to date, place and person. She sleeps well. In the hospital she had no vomiting and no incontinence of bowel or bladder. She is slightly tearful at times but is not difficult to manage. She unquestionably has some disturbance of attention.

"She walks with a wide base, slightly spastically and is very unsteady on her feet with a definite tendency to retropulsion, inconstantly to right or left. When standing with the eyes closed, she tends backward and slightly to the right. Her head is held in the natural position, not inclined to right or left.

"Her speech is slightly indistinct in some of the longer words but is not typically slurred. Her head is 21¾ inches in circumference. She has a definite well-marked Macewen's sign and the roentgen rays show definite widening of the coronal and lambdoidal sutures. She hears well with either ear. She sees fingers well at four feet with either eye. She has a definite bilateral nystagmus, not definitely more marked on looking to the right or left, but with the fast component in the direction in which she is looking. She has no constantly demonstrative squint although the left eye is slightly more turned upward than the right. Her face moves equally. The tongue, throat and forehead are all equal. She feels a pin-prick equally on either side. She has well marked corneal reflexes on either side. The pupils are equal, react to light and consensually, are concentric and show no irregularity. The optic disks are slightly pale, the disk margins clear, regular in outline and do not suggest any recent edema on the right side, but on the left there is a slight lack of definition to the disk margin, particularly in the upper nasal side. The vessels are full and tortuous. The fields of vision appear slightly impaired, particularly on the temporal fields, but this is made only with a gross clinical test and the child's attention is difficult to hold.

"Her arms and legs show no atrophy. She has voluntary power in all her limbs and no gross difference can be made out between the two sides. At rest, the limbs show no tremor of a gross or of a fibrillary type. On volition with movements of accuracy with the fingers, there is a slight ataxia of cerebellar type. With the arms and fingers extended and the eyes closed, each arm

gradually seeks a lower position accompanied by a slight coarse, static ataxia. It is bilateral. The same condition obtains in the lower limbs. There is a slight but definite rebound phenomena on either side. She has fairly well marked dysdiadokokinesia. The deep reflexes in the upper limbs are difficult to obtain but are present. The knee and ankle jerks are present and equal. Plantar responses are flexor. There is no gross disturbance of sensation in the limbs or trunk.

"*Opinion.*—It is my opinion that this child in all probability had some cerebellar complication of either whooping cough or influenza in the spring of 1921, and since this time her physical and mental conditions have gradually been interfered with as a result. The diagnosis would appear to be this or a slow growing cerebellar tumor. The condition would appear to be unquestionably bilateral, and as yet has not much invaded the anterior surface of the pons and medulla, but is gradually causing an internal hydrocephalus and the mental symptoms from pressure.

"*Recommendation.*—I would recommend that this child have an occipital decompression in the near future."

Roentgen-Ray Examination.—In the right frontal region some exceptionally large and wide venous channels were shown on the inner table of the skull. The pituitary fossa appeared somewhat large, and the posterior clinoid processes appeared very small and may possibly have been largely absorbed. Convolutional markings on the skull were somewhat more definite than usual, and lambdoid and coronal sutures both appeared somewhat wider open than normal, as though from increased intracranial pressure. The case suggested a tumor in the pituitary fossa or above it, but the roentgen-ray signs were not sufficiently marked to be conclusive in themselves.

Laboratory Findings.—The cerebrospinal fluid showed no pus cells, no organisms and a sterile culture after twenty-four hours; the pressure was definitely increased 21 inches; a very faintly positive Noguchi sign was noted; the Wassermann blood and spinal fluid reactions were both negative. The tuberculin tests were all negative.

Second Admission.—After three days out of the hospital, the patient was readmitted May 25, to the surgical service for operation.

Operation.—May 26, Dr. Gallie performed cerebellar decompression.

Progress in Hospital.—The child made a good postoperative recovery. On June 25, Dr. Boyer described her condition as follows:

"The patient has been up and around the ward for one week and encouraged to do any walking possible. Her mental condition is unchanged. She is still rather emotional, easily dissociated and inattentive but otherwise does not present any signs characteristic of progressive mental change. Her head shows a positive Macewen's sign and there is a slight bulging of the occipital decompression on the right side. She holds her head somewhat forward. She walks with a wide base (wider than previously), and with some suggestion of spastic character in it. She has a bilateral nystagmus, which is more marked on looking to the right. Her pupils are equal, react to light, concentric. The optic disk on the right side is clearer in outline than the left, somewhat pale but the vessels show no marked changes. The outline of the left optic disk is indefinite, particularly in the superior quadrant and is slightly pale. The movements of the face, tongue and palate do not signify any marked lesion. There is no question that the pointing finger on the right side is more ataxic and gradually seeks a lower position than on the left. This is more marked on closing the eyes.

"The left knee jerk is definitely more easily obtained than the right and is quicker in response than the right jerk. The right knee jerk is about what is considered normal. The same applies to the ankle jerks. Plantar response on the right is flexor; the left is neither flexor nor extensor. The child has no marked sensory changes.

"Opinion.—From this and the former examination, I am of the opinion that the condition in this child's posterior fossa is progressing.

"Recommendation.—I would recommend a further exploration of the posterior fossa of the skull after ventricular drainage."

Otologic Examination.—The first examination was made June 27.

Spontaneous Phenomena.—1. Ears: both drums normal; hearing good and equal on both sides. 2. Nystagmus: looking ahead, none; looking down, none; looking up, slight; looking to the right, marked mixed nystagmus of medium rate and wide amplitude, quick component to right, chiefly horizontal with some rotary element; looking to the left, same as looking to the right except that quick component is to left. 3. No paresis of the throat musculature was noted. 4. Ataxia and asynergy of both arms ad legs were as described in Dr. Boyer's note. 5. Past-pointing: The right arm touched; the left arm and left forearm past-point inward. 6. Romberg sign: the child swayed backward (?).

Induced Phenomena.—1. Rotation: Slow rotation twice to right without abrupt stop produced second grade horizontal nystagmus to the left and vertigo. Same to the left produced same responses with quick movement to the right. 2. Caloric tests: Water at 65 degrees F. Right ear: (*a*) no rotary after-nystagmus after 60 inches; (*b*) wide horizontal after-nystagmus to left.

The second examination was made June 28.

Induced Phenomena.—Left ear, with the water at 60 degrees F., with the head 30 degrees forward: 1. No after-nystagmus at the end of douching for five minutes. 2. No vertigo or nausea. 3. Past-pointing: no change from spontaneous: with the head 60 degrees back. 4. Good wide horizontal after-nystagmus. 5. Slight vertigo, no nausea. 6. Past-pointing: right arm past-pointed 3 inches to left; left arm, same as spontaneous.

The third examination was made June 29.

Right ear, with the water at 65 degrees F., with the head 30 degrees forward: 1. Good wide nystagmus, second grade, after one minute; douching continued one minute and thirty seconds chiefly horizontal in type, quick to left. 2. No nausea or vomiting. 3. Past-pointing: both arms past-pointed well to right, with the head 60 degrees back. 4. Marked rapid wide after-nystagmus, quick to left. 5. No nausea, no vomiting. 6. Past-pointing: both arms past-pointed widely to right.

Summary.—1. Spontaneous nystagmus, which was equal to both sides. 2. Constant past-pointing error with left arm, deviation to right. 3. Abnormally active ocular response to rotation. 4. Normal ear drums and hearing. 5. Normal ocular and past-pointing response to stimulation of horizontal canal on right side. 6. Normal past-pointing response to stimulation in the right vertical canals. 7. The ocular response to stimulation of the right vertical canals was normal in time and direction but abnormal in being horizontal instead of rotary. 8. Past-pointing response to stimulation of the left vertical and horizontal canals was abnormal (the only normal response was from the right arm from the horizontal canals). 9. Normal ocular response to stimulation of left horizontal canal. 10. Abnormal (absent) response to stimulation of the left vertical canals.

Impression.—1. No peripheral lesion of either eighth nerve. 2. No lesion of either eighth nerve external to superficial origin. 3. Phenomena observed are such as are caused by pressure in the posterior fossa. 4. The lesion is intracerebellar. 5. The lesion is more on the left than on the right side.

Operation.—On June 30, Dr. Gallie explored the cerebellum. The lateral ventricle was tapped and 55 c.c. of fluid was removed. Both cerebellar hemispheres were exposed. The right cerebellar hemisphere bulged more than the left at one point just to the right of the sinus and at a lower limit of the hemisphere it appeared to be slightly grayish-blue. A needle was passed straight in at this point for one-half inch; when it was withdrawn about 18 c.c. of moderately clear brown-colored fluid, which was not of the same color as the

cerebrospinal fluid and no doubt was from a cyst, escaped. The brain tissue at this point was raised and this opened up a fairly large, rather thick walled cavity, lined with whitish-looking material. In the superomedial wall of this cavity, a tumor could be felt which was semisolid in consistency and apparently extended for some distance to the left of the cyst wall. The diagnosis was considered to be either a tubercle or a gliomatous cyst of the right cerebellar hemisphere.

Progress.—The child made good recovery from the operation and on the eighteenth day Dr. Boyer described her condition as follows:

"The child is up and around the ward and walks alone with a wide base, but better than before either operation. Her pupils are equal, 3 mm., and react well to light. Her optic disks are pale, but clear in outline, rather suggesting atrophy. She has double lateral nystagmus. She has no facial or tongue paralyses and no sensory disturbances. There is less static ataxia with the right hand, and much more coordination in the movements. The deep reflexes are present and easily obtained on either side.

"The patient was discharged home in good general condition and with the wound well healed, on July 27."

In June, 1924, this patient showed a definite tendency to hydrocephalus (head circumference, 22½ inches). She was unsteady and wide based in her gait. She had marked bilateral nystagmus and definite signs of optic atrophy. She could walk and even run. Her deep reflexes were now disturbed. Her mother stated that she was whimsical and emotional. She often complained that she would roll out of bed and declined lying down because "everything is in her head." She had a large mass protruding through the occipital hiatus which transmitted light readily, especially in its upper part. In March, 1925, this child was still alive and was said to be "in the same condition" by the mother but no detailed examination could be made.

CASE 5.—*Glioma of Cerebellum.*—H. H., a girl, white, aged 4 years, was admitted on May 29, 1923, for observation. The chief symptoms were headache and intermittent vomiting for the previous two months.

History.—The child was quite well until about April 1, when she developed a cough, her nose began to "run," and she complained of headache. She was not feverish, the bowels were regular, the appetite was poor and at the onset she did not vomit. A physician ordered some medicine. The cough gradually became more severe until the child developed a definite whoop about April 4. The child was restless and slept poorly at night, and the parents noticed that the head seemed to be tilted toward the left side. About April 7, the child was given an injection of whooping cough vaccine into the back and one hour afterward she seemed sick and complained of her back being sore (at the site of injection) and wanted to lie down and be left alone. She was not feverish, refused practically all her food and complained of headache. On April 9, the injection was repeated; the next morning the child vomited after a spell of coughing, and while lying down suddenly screamed with the pain in her head. She was irritable and did not want to be disturbed. Her head was still tilted to the left. Nothing unusual was noted about her gait or her ability to use her limbs.

Since April 10, the child vomited after every spell of coughing. She was up but was allowed to rest whenever she desired. Injections of whooping cough serum were repeated April 11 and 13.

From April 13 to May 1, the cough seemed to become less, but the child's general condition was getting worse. The headache and vomiting continued. The father stated that the vomiting was more pronounced and more liable to occur when the headache was severe.

The vomiting was never projectile. The vomitus consisted of phlegm, watery material and froth. There was no fever. The appetite was poor. The child was losing weight and was restless and irritable.

About May 1 the father noticed that the child appeared not quite sure of herself when walking as she would look at her feet, and would stumble and stagger occasionally. He stated that the child's gait had definitely changed.

During the month of May the cough became less, the vomiting continued (occurring three or four times in twenty-four hours), the headaches were severe and persistent, the appetite was poor, the head was tilted to the left, the gait was unsteady and the child was irritable. Dr. Alan Brown was consulted on May 23, and had the child admitted to hospital on May 28.

Condition.—A fairly well developed and nourished child, lying comfortably in bed, apparently not acutely ill was seen. The head was inclined to the left. There was no nystagmus. The pupils were equal and reacted normally. The intelligence was apparently normal but the child did not cooperate well. She walked, but did so with a rather wide base. The urine contanied a few pus cells. The neurologic findings were the same as those given in Dr. Boyer's note. Lumbar puncture was done. The cerebrospinal fluid showed neither cells nor organisms and the culture remained sterile for forty-eight hours. A request was at once made for a neuro-otologic examination. This was made the following day, May 29, and repeated on May 31. The reports were as follows:

First Otologic Examination.—Spontaneous Phenomena: 1. No nystagmus in any position of eyes. 2. Tendency to squint at times. 3. Head kept tilted to left. 4. Romberg sign, gait and coordination could not be accurately determined as the child did not cooperate. 5. Both canals contained much dry epithelium and wax. After this was removed, both drums appeared quite normal. 6. There was no paresis of the throat muscles. 7. Hearing: The child answered questions with noise box in opposite ear.

Induced Phenomena.—Dry cold air, that is, a caloric test was made on each ear. 1. Both ears produced a perfectly normal horizontal after-nystagmus. 2. The right ear produced a slight rotary after-nystagmus. 3. The left ear produced no apparent rotary after-nystagmus.

Impression.—1. There was no peripheral lesion of either the cochlear or vestibular division of either eighth nerve. 2. I desire to repeat examination of child in the hope that next time she will cooperate better and allow more accurate observation.

The second examination was made May 31. The ear examination was repeated.

Induced Phenomena.—After the cold air caloric test, it was the same as on May 29.

Conclusion.—There is definite interference in the pathway between the vertical semicircular canals of the left ear and nuclei innervating muscles producing rotary nystagmus.

Laboratory Findings.—A few pus cells were found in the urine daily for the following three weeks. On May 31, the cerebrospinal cell count was 2, with a negative Noguchi test. The Wassermann reaction on the blood and spinal fluid was negative. Human and bovine tuberculin skin tests were all negative. The Schick test was positive and the child was given 1,000 units of antitoxin. The blood counts and hemoglobin were normal.

Progress.—The tonsils were considered large and unhealthy. The child was kept in bed for eighteen days and no vomiting occurred. The temperature fluctuated between 97.8 and 100 F. The respiration varied from 20 to 26. Her pulse rate was between 80 and 112 but was once noticed to be 64.

Dr. Boyer, chief of the neurologic service, made the following summary of her condition:

"*Neurologic Examination.*—This child is up and walks without any definite locomotor difficulty; the head is inclined very slightly to the left. She cries easily and is difficult to examine satisfactorily.

"The pupils are equal, 3 mm., concentric and react to light. I cannot satisfactorily demonstrate any spontaneous nystagmus whatever. Her optic disks do not show sufficient abnormality to justify an opinion that a pathologic condition exists, or has existed there in the past. She apparently hears well and she talks a good deal in the ward, although she refused to talk to me the day of examination, or on any former examination. The face, tongue and throat show an equal innervation. She uses her hands without ataxia. Her biceps, triceps, supinator, knee and ankle jerks are all present and equal and are not unduly exaggerated. Her plantar responses are flexor.

"Considering the degree of infection in the tonsils and the degree of their enlargement, I would be inclined to consider this case as one of an infective or toxic nature, but at this time one cannot exclude the possibility of an intracranial neoplasm developing in the posterior fossa, but the only suggestive neurologic sign shown in this child is the position of the head. Other than this and the history of vomiting, there are no suggestive symptoms of increased intracranial pressure."

The following is an account of the second admission and history during an interim of six months. The child was readmitted Jan. 14, 1924, for severe paroxysmal headaches, attacks of vomiting with loss of appetite and sleep of five weeks' duration.

The tonsils and adenoids were removed four weeks after discharge from the hospital. The child had been well and the mother stated that the child had been very intelligent until the onset of the present attack. Five weeks ago, she began to have severe headaches. The pain was so bad that she screamed during the attacks and the most painful part appeared to be the frontal region. While the headache was severe the child would vomit and this seemed to give some relief. The vomiting was most severe during the night. She would often wake up screaming with pain and would then vomit. The attacks of headache and vomiting varied in severity, sometimes being quite slight. The mother stated that the child was getting worse and that recently the attacks had been lasting longer. There was no history of fits. The appetite was poor and the child was losing weight. Between attacks the child would sleep quite well. These attacks came on suddenly.

Condition.—The child was well developed and nourished, not acutely ill.

Examination other than neurologic, showed nothing of significance. Otologic examination was not requested and I was not informed that the patient was again in the hospital.

Neurologic Examination.—Dr. Boyer reported: "The child is irritable and easily disturbed. The left side of the face is not so expressive as the right. The gait is unsteady and hesitating. The left lower limb is not moved as dexterously as the right. The knee jerks are present and easily obtained. The ankle jerks are the same. The plantar responses are flexor. No ataxia or nystagmus is noted. Impression: Encephalopathy after whooping cough."

Dr. W. W. Wright reported: "The right disk is not clear cut. The left disk shows distinct beginning papilledema. The disk margins are quite blurred, especially on the nasal side with some engorgement of veins."

Roentgen-Ray Examination.—Nothing was shown in the skull which appeared to be of any pathologic importance. The same peculiar blood channels were shown as before.

Progress.—Four days after admission, the patient vomited for the first time and complained of headache. The child was transferred to the infectious ward with the diagnosis of suspected scarlet fever, which became definitely positive on January 25, nine days after admission. On February 7, the child complained for the first time of frontal headache and after being nauseated, vomited her breakfast. At the commencement of the attack, the vomiting was apparently projectile but did not continue so. The child continued to complain of frontal headache, was drowsy and apathetic and vomited her dinner. The following

day was uneventful, but on February 9, the child vomited her breakfast and complained of slight frontal headache. She continued listless and apathetic throughout the afternoon and at 7:45 p. m. vomited, became unconscious and her extremities became quite rigid. On the conclusion of the attack, which lasted for about fifteen minutes, she lay on her side and screamed out frequently. When asked, she complained of severe frontal headache. The pulse rate averaged 60, the respirations were irregular, and the temperature 97.3 F. per rectum. About 8:30 p. m. she again lapsed into an unconscious state with rigidity of the extremities. Lumbar puncture obtained clear fluid with a cell count of 6. The child died at 10:10 p. m.

Postmortem Examination.—Description of Brain: Both cerebral hemispheres appeared normal. The right side of the cerebellum was considerably larger than the left (Fig. 5). There was a tumor mass largely filling this

Fig. 5 (Case 5).—Glioma of right half of cerebellum.

half of the cerebellum and pressing on its inferior surface. The portion seen on the inferior surface measured one and one-half by three-eighths of an inch: this appeared to push the medulla and pons somewhat to the left. Some edema was noted in the pia-arachnoid space about the medulla (Fig. 6). On section, a grayish translucent tumor was seen, which nearly filled the right lobe of the cerebellum. The tumor was round and well circumscribed. It was about 2 inches in diameter. No hemorrhage was seen. The histologic diagnosis was glioma.

Comments.—At the onset of the symptoms of this case, the clinical and neurologic findings were so inconclusive that the definitely expressed otologic opinion was held in abeyance, and the hospital lost sight of the patient for several months. The outcome proved the correctness of the general indication obtained by the one ear test. The ear examination showed evidence of a posterior fossa lesion. The evidence was that the lesion lay in the pathway

between the vertical semicircular canals of the left ear and the nuclei innervating the muscles producing rotary nystagmus. Necropsy showed that the tumor occupied the right half of the cerebellum. This point will be commented on further.

CASE 6.—*Gliosarcoma of Cerebellum.*—E. W., a boy, white, aged 10 years, was admitted to the hospital Jan. 12, 1924, for observation. The chief symptoms were vomiting and vertigo.

History.—When convalescent from chickenpox about two weeks ago, the boy developed a slight cold and complained of pain in the left ear. Since then there had been intermittent pain not of severe grade in the left ear and intermittent headache of severe grade which occurred chiefly in the occipital region. Ten days prior to this, he vomited after taking food; since then he had vomited one or more times a day. During the last two days, he became dizzy when sitting up and was rather drowsy. The appetite was poor, the bowels sluggish.

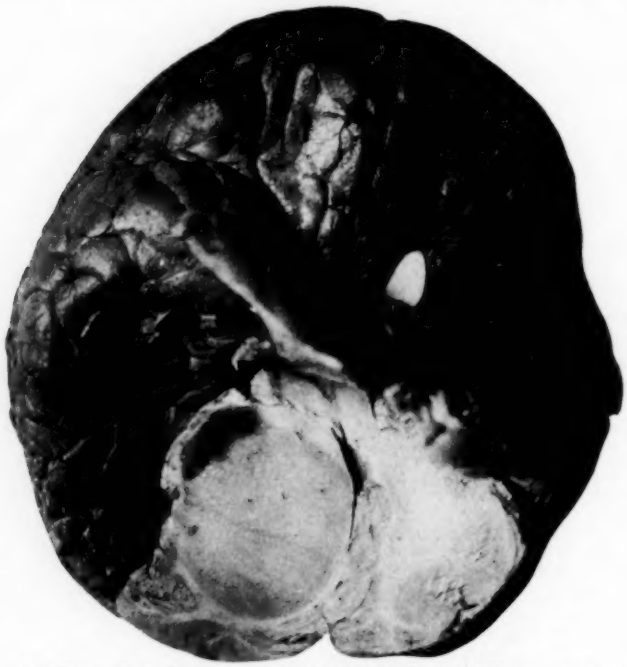

Fig. 6 (Case 5).—Glioma of right half of cerebellum, on section.

Condition.—January 15, the boy was sitting up. He answered intelligently but was not bright. He was right-handed. The only complaints were tenderness on pressure below the left auricle and slight dizziness. There were no nystagmus and no past-pointing error. Both ear drums were much the same. The center of the drums was considerably retracted and adherent to the promontory, otherwise they were normal. The hearing was equally diminished, the boy heard a whisper at one foot. The pharynx was irritable and subacutely inflamed, especially on the left. Subjective vertigo: objects seem to move from right to left.

January 18, a roentgen-ray report was made. Dr. Albert H. Rolph reported that the only abnormalities showing in skull were as follows:

"Outlines of the sella turcica are slightly ragged and indefinite, giving just a suggestion of some absorption of bone there. In left frontal region about 0.5 inches above the outer portion of the left orbit, a circular area of the bone

of the vault of the skull, about three fourths of an inch in diameter, has an indefinite and rarefied appearance, quite unlike that of any part of the vault, the central part of the area being slightly denser than the remainder."

January 19, Dr. Boyer reported:

"The patient is somewhat more lethargic than previously. The head tends to the right. The optic disks are clear in outline, the cups have disappeared. The veins are prominent. There is no definite swelling, although the region is slightly congested. The eyes have full movement. There is no nystagmus. The tone of the arms is good. The child opens and closes the hands well. Deep upper and lower reflexes are normal. Abdominal and plantar reflexes are normal. Sitting up produces headache in the frontal region.

"Recommendation.—Repeat lumbar punctures."

It was decided to give the boy a careful neuro-otologic examination before and after lumbar puncture.

Otologic Examination.—The first examination was made January 19, at 12 a. m.

Spontaneous Phenomena.—1. The patient was apparently oriented and not distressed. 2. No nystagmus was present. 3. There was no past-pointing.

Induced Phenomena.—The patient was lying down, with the head 60 degrees back, and the water at 66 degrees F.

Right Ear: 1. Horizontal nystagmus quick to left, second degree after twenty-five seconds. 2. The right arm past-pointed 6 inches to the right, the left arm touched. The horizontal nystagmus continued. 3. The boy sat up with the head 60 degrees forward, the nystagmus disappeared. 4. Past-pointing was not tried. 5. The boy lay down again and the horizontal nystagmus returned.

Left ear, lying down with head 60 degrees back: 1. Horizontal nystagmus, second degree, quick to the right after twenty-five seconds. 2. No past-pointing, the horizontal nystagmus continued. 3. The boy was made to sit up with the head 30 degrees forward, the nystagmus disappeared. 4. Past-pointing was not tried. 5. He lay down again with the head 60 degrees back, and the horizontal nystagmus returned.

Summary.—1. The drums were retracted with equally slightly diminished hearing. 2. There was impairment of response by the eyes to caloric test of each ear, that is, no rotary ocular after-nystagmus from either ear. 3. Good horizontal after-nystagmus from caloric test, each ear. 4. Normal past-pointing with the right arm, right ear. 5. The caloric test otherwise gave no past-pointing response.

Impression.—1. The end-organ of both eighth nerves was normal. 2. There was an increase of intracranial pressure, probably due to subtentorial lesion.

Following the examination, spinal puncture was performed and 20 c.c. of fluid was withdrawn. No cells and no organisms were seen. The culture remained sterile for forty-eight hours. The boy became drowsier than in the morning.

The second examination was made January 19, one and a half hours following the lumbar puncture.

Spontaneous Phenomena.—1. No nystagmus. 2. Slight headache. 3. The boy was drowsier than in the morning. 4. There was a tendency to past-pointing outward with the right arm repeatedly, slight tendency to outward past-pointing with the left arm.

Induced Phenomena.—Left ear, the same as the morning except: 1. Definite past-pointing to the left with both arms. 2. Nystagmus in the upright position could not be observed because the boy complained of too severe headache. 3. When the head was turned 90 degrees to the right, the nystagmus greatly increased; when turned 90 degrees to the left, the nystagmus was reversed and much diminished.

The right ear was the same as in the morning except: 1. Definite past-pointing to the right with both arms, but right arm not increased over spon-

taneous. 2. When erect there was a total absence of nystagmus. 3. On the back, with the head turned 90 degrees to the right, nystagmus was reversed and much diminished; turned 90 degrees to the left the nystagmus was greatly increased. (It was noticeable that the nystagmus after stimulation lasted a long time [five minutes]. Toward the end of the nystagmus, there was a marked tendency to conjugate deviation of eyes to the side stimulated.)

Summary.—One and one-half hours after spinal puncture, the condition was the same as in the morning, except for the definite appearance of the correct type of past-pointing. This confirmed the impressions of the morning.

Progress.—On January 26, the boy was removed to the medical ward where Dr. Boyer made the following note:

"No complaints. The disks examined under atropin showed the right disk normal, the left disk edge not as clear as the right and a little pigment above in the retina, otherwise negative. With his eyes open, the boy walks fairly steadily. With the eyes closed he tends to the left. Extended arms: The left gradually gravitates to a lower plane. No difference is noted in the hand grips. He has no ataxia. Knee jerks are present, equal and normal. Plantar responses are flexor. The boy complains of being tired.

"Recommendation.—Repeat lumbar puncture."

Otologic Examination.—The third examination was made January 30.

Spontaneous Phenomena.—1. No headache. 2. No vertigo on sitting up. The boy felt well and active. 3. Nystagmus: on looking to extreme right, there was definite horizontal nystagmus quick to the right, slight on looking to the left. The difference was very marked. It was the same when lying or sitting, none in any other position of eyes. 4. Past-pointing: upright, right arm, no deviation; left arm, a constant tendency to past-point inward. Lying down, the right arm deviated outward; the left arm, majority touch.

Induced Phenomena.—Water at 66 F. Left ear, with the head 30 degrees forward: 1. Only after douching for 1 minute and 35 seconds did an occasional rotary twitch to the right occur. 2. No dizziness. 3. Past-pointing: right arm touch (same as spontaneous); left arm (repeatedly inward), same as spontaneous. With the head 60 degrees backward: 4. Very good wide horizontal after-nystagmus, quick to the right. 5. Slight dizziness, sense of falling back. 6. Past-pointing: right arm, touch (correction of spontaneous), left arm, repeatedly inward, same as spontaneous.

Right ear, with the head 30 degrees forward: 1. Slight second grade rotary after-nystagmus quick to the left after two minutes. 2. No vertigo. 3. Past-pointing: right arm, slight deviation to right; left arm, repeatedly inward, same as spontaneous. With the head 60 degrees backward: 4. Good wide horizontal after-nystagmus. 5. No vertigo. 6. Past-pointing: right arm, no devation; left arm, repeatedly inward, spontaneous slightly increased.

Summary.—1. The present but much delayed rotary ocular response in a quiescent period is quite in keeping with the previous observation and impression. 2. The past-pointing phenomena are distinctly abnormal.

Progress.—February 2, Dr. Boyer reported:

"Coordination is good. Good attention and no disturbance of emotion or cerebration. Right optic disk normal. Left optic disk is not quite normal and shows slight signs of increased intracranial pressure. The boy walks with some disturbance of equilibrium but not constantly to right or left, today making more errors to the right than to the left. He is a little more unsteady with his eyes closed. He has slight but definite nystagmus to the right. Power in the legs, arms, hands, face, tongue and throat is equal, but slightly weaker than one would expect. He has no spontaneous tremors and no ataxia. Abdominal reflexes are present and equal, the plantar responses are flexor. Knee jerks are present, but greater on the left. The ankle jerks are also present.

I cannot make out any difference in deep reflexes of upper limbs. He spontaneously points correctly with the right hand, but points 2 or 3 inches to the right with the left hand.

"Opinion.—I feel that this boy has an infectious or toxic lesion in the cerebellum, and the evidence points to the right side being more involved than the left at present.

"Recommendation.—Advise observation.

"Standing with the feet together and the eyes open, the station is fairly good. Standing with feet together and the eyes closed, the boy tends somewhat forward and somewhat to the right."

Otologic Examination.—The fourth examination was made February 8.

Spontaneous Phenomena.—None.

Induced Phenomena.—Caloric test, with water at 66 F. The left ear, with the head 30 degrees forward: 1. The ear was douched for five minutes with absence of rotary nystagmus. 2. No past-pointing. 3. No nausea or vertigo. With the head 60 degrees back. 4. Good horizontal after-nystagmus, quick to the right. 5. No past-pointing. 6. No nausea or vertigo.

Right Ear: with the head 30 degrees forward. 1. Fair rotary after-nystagmus quick to the left. 2. Past-pointing abnormal. 3. No vertigo or nausea. With the head 60 degrees back: 4. Excellent horizontal after-nystagmus, quick to the left. 5. Past-pointing, abnormal. 6. No vertigo or nausea.

Impression.—I still consider there is a lesion in the posterior fossa.

Progress.—March 15, Dr. Boyer reported:

"This boy has had headaches at intervals for the last two weeks, chiefly on sitting up. He walks with a wide base, the head inclined to the left and turned slightly to the left. In walking, he tends backward and to the right. This is unusually constant. His eye movements are full. There is no vertical nystagmus. There is marked nystagmus to the right and slight to the left. The boy hears well with either ear. His optic disks show increasing intracranial pressure, as the veins are fuller and the disk edges are much less clear. There is no marked difference between the two sides now. His face and tongue innervations are equal. He feels cotton wool well all over face. There is no local ataxia on either side, but there is a general condition of poor muscular tone. The deep reflexes do not show any difference between the two sides. His spontaneous vertical pointing shows constant touching on right with slight incoordination, while on left he sometimes touches, but half the time he goes either to right or left, while he previously always pointed from 1 to 2 inches to the left. His finger and nose tests show slight ataxia on the right. He is slightly worse with the eyes closed. Reciprocal activation and inhibition are impaired on the right.

"Opinion.—In my opinion, this patient is developing a right sided cerebellar cyst or tumor."

March 29, Dr. Boyer reported: "This patient has more headache and more vomiting. Two days ago, the right ear started to discharge. He will not sit up on account of headache and he cannot walk. His pupils are dilated (atropin). Both optic disks are choked with complete obliteration of the edges. He has bilateral nystagmus, more marked to the right. He hears in the left ear. His speech is loud and slow. His forehead, face and tongue move equally. He has no squint. He has voluntary power in the arms, forearms, hands, thighs, legs and feet. There is no spasticity. The right hand grip is slightly weaker than the left. There is no difference in tone of the muscles of the limbs. At rest there is no spontaneous tremor. On volition there is no ataxia. The movement is well effected. Biceps, triceps and wrist reflexes are present and equal. The knee and ankle reflexes are greater on the left. Plantar: right, no response; left: slight extensor (?). The boy has no neck rigidity. The head still inclines to the left and turns slightly to the left. The

pointing tests when lying down show more error to the right with the right hand, while the left nearly constantly touches. His extended hands held obliquely out show slight coarse movements of the right with gradual elevation of right. He has a positive Macewen's sign.

"Opinion.—It is my opinion that this boy should have a cerebellar decompression done at once."

Roentgen-Ray Examination.—April 1, Dr. Rolph reported:

"Convolutional markings on inner table of skull are now very prominent and the coronal suture is being definitely opened by intracranial pressure."

Operation.—April 8, Dr. Gallie performed a cerebellar decompression. The boy died the day following the operation.

Postmortem Examination.—A soft tumor mass about two and one-half inches in diameter was found between the two halves of the cerebellum.

Histologic Diagnosis.—Gliosarcoma.

CASE 7.—*Gliosarcoma of Pons and Medulla.*—G. T., a boy, white, aged 11 years, was admitted to hospital Aug. 28, 1924, complaining of headache and a tendency to fall to the left, of a year's duration; all more marked during the previous eight weeks.

History.—For one year the child had frequent periods of nausea and vomiting accompanied by severe headache which had no relation to meals. He also had frequent spells of dizziness but the mother cannot remember whether these accompanied the nausea or not. The dizziness occurred at rest as well as when active. There was no history of any possible cause of these attacks.

The eyes were examined by Dr. Charles Kister, St. Catherines, who found nothing abnormal. The boy was clever, did not seem to have deteriorated mentally but had become careless and wasted his time.

He was short of breath on exertion. There had been no edema. He had a ravenous appetite, and voided a great deal, getting up once a night to void. There were no night sweats.

Eight weeks ago, the boy was out in the sun and came home with bloodshot eyes and with the head inclined to the right. He tended to fall to the right. The following morning he vomited a little, was dull and listless, ate his meals without difficulty and complained of pain in the back of the neck and across the forehead. The inclination of the head to the right persisted for four days, then inclined to the left.

Since that time he has been much the same; excessively sleepy, irritable, somewhat dull and growing progressively weaker, with a tendency to fall to the left.

During the last two weeks the boy failed rapidly, he grew weaker, the headaches have been more constant, he vomited a great deal and the upper eyelids drooped. He still ate and voided as before. During the last few months he held books close to his eyes when reading.

Condition.—A rather poorly developed child, apparently not acutely ill was seen. He did not like sitting up, as he felt dizzy when he did so, and tended to fall to the left. There were no meningeal signs. He was admitted for observation for cerebral tumor. All tuberculin tests were positive. The Wassermann test was negative for both blood and cerebrospinal fluid. Fifteen cubic centimeters of clear spinal fluid under normal pressure was removed and showed a cell count of 4 lymphocytes. The Noguchi test was positive. The general examination was not remarkable.

Neurologic Examination.—On September 5, Dr. Boyer reported:

"The patient's mentality is not impaired: he is mentally alert and cooperates well. His optic disks show no typical edema or change in the vessels or retina. His hearing is good on both sides. His face appears bilaterally equal in movement. The left arm and leg are slightly weaker than the right and there is less tone in these limbs; the left knee and ankle jerk are obtainable but

I cannot satisfy myself that the right knee and ankle jerk are present. The left abdominal reflex is not obtainable, the right is just present; the left plantar reflex is extensor. Macewen's sign is suspicious but not definitely present."

Progress.—By September 17, the chest had been reported negative for clinical tuberculosis. A roentgenogram of the skull failed to show definite abnormality and the skin tuberculin tests had been repeatedly positive. The patient complained of headaches practically all the time, was sleepless, requiring sedatives, and vomited frequently, especially in the mornings. Dr. Boyer expressed the opinion that the boy had a cerebellar tuberculoma and asked that the vestibular tests be made. On September 20 he reported:

"With the boy's left-sided facial and tongue weakness, which is very slight, with the progression of limitation of bilateral conjugate movements of his eyes, his left-sided ataxia and well-marked atonia, I am of the opinion that he has an infiltrating lesion of the posterior fossa. With the persistently positive tuberculin reactions and the globulin in the cerebrospinal fluid, the possibility of this being a diffuse tubercular lesion must not be lost sight of. I recommend suboccipital decompression, more on the left side. This may relieve the boy's headaches and vomiting somewhat."

Otologic Examination.—This examination was made September 21.

Spontaneous Phenomena.—The eye movements (*a*) lying on the left side on pillow. 1. Straight ahead, slightly downward, no movement. 2. Looking to left: left eye, slow lateral nystagmus to the left, the right eye, slow nystagmus upward. 3. Looking to the right; slow irregular rolling movements. The left eye can move to left, up or down completely, but not completely to the right. The right eye can move completely up or down but not to the right or to the left.

(*b*) Lying on the right side on the pillow. The same, except that both eyes can move almost completely to the right. 1. Looking upward, quick nystagmus upward. 2. Left pupil larger than the right.

(*c*) Lying on the back, the boy said he felt sick. Looking to the left, left lateral nystagmus in the left eye; right eye, slight vertical nystagmus.

(*d*) Lying prone with the head at an angle of 30 degrees from the vertical. Straight down, no nystagmus; looking to left, same as before; looking up, same as before; looking down, no nystagmus; looking to right, slow ineffectual movements to right.

Coordination: touched nose with right finger, left arm complete failure.

Induced Phenomena.—Caloric test was made with water at 65 degrees F., with the patient lying face downward.

Left ear: Douched left canal for five minutes without any nystagmus or any discomfort to patient.

Right ear: Occasional twitch to right at end of two minutes and present every few seconds for remainder of five minutes douching. (Note: Nausea when turned on back or sitting up prevented observation in these positions. In the prone position, past-pointing was not attempted.)

Summary.—1. Spontaneous nystagmus and paresis as noted. 2. Ataxic movements with the left arm. 3. Nausea in any position except prone. 4. Normal drums and hearing. 5. After caloric stimulation, total absence of ocular response from left ear and almost complete absence from the right ear. 6. No nausea or vertigo were present after prolonged stimulation of each ear.

Conclusion.—Definite block of vestibulo-ocular reflex paths on both sides, the left greater than the right. I feel there is a posterior fossa lesion.

Subsequent Progress.—On September 25, the boy was taken to the operating room for suboccipital decompression. Respiration ceased during the induction of anesthesia and became reestablished only after thirty-five minutes of

artificial respiration. Operation was postponed. After recovery, the patient complained constantly of headache and vomited frequently. Two days later he was discharged to St. Catherines' Hospital. There he had one serious collapse of about two hours' duration, but a second and fatal collapse occurred about seventeen days after his admission there. He expired suddenly while being turned in bed. Two days prior to death there was no sign of edema or of optic neuritis.

Postmortem Examination.—Sagittal section revealed a comparatively normal cerebellum lying above and behind a tumor mass arising apparently in the pons (Fig. 7). This mass was roughly the size and shape of a medium sized hen's egg, measuring about 5 by 4 by 3 cm. In the anterior portion of the pons it appeared to extend through to the inferior surface, while posteriorly there was a layer of pontile fibers about 6 mm. in thickness, which appeared to be uninvolved by the tumor. There was no definite line of demarcation between the tumor and the pons, the former shading off gradually into the latter. The upper and posterior surface of the tumor for the most part was smooth and protruded into what was formerly the fourth ventricle, having

Fig. 7 (Case 7).—Gliosarcoma of pons and medulla.

no attachment whatever to the inferior surface of the cerebellum which had been displaced upward for a considerable distance to allow for the increasing size of the tumor. The greater part of the tumor was of ordinary consistency and the cut surface was of a homogeneous white color. In the upper portion, however, there was an area about 2 cm. in diameter, which was yellowish-gray and rather soft and pliable. This portion presented the appearance of degeneration.

Histologic Diagnosis.—Gliosarcoma.

In all of these cases, a blood Wassermann and a spinal-fluid Wassermann test were inactive on at least one occasion.

TABLE 1.—*General Survey of Cases*

Case	Name	Provisional Diagnosis	Neurologic Diagnosis	Otologic Diagnosis	Outcome	Final Diagnosis	How Proved
1	W. L.	For observation	Subtentorial lesion of the cerebellum involving the vermis and the lateral lobes, and more especially the right, but to some extent the left	Organic intracranial subtentorial lesion affecting the right side more than the left	Died	Intracerebellar tumor on the right side with a cyst on the left	Operation, Oct. 17, 1923
2	H. K.	Cerebellar tumor	Intracerebellar tumor, more on right side than on the left	Organic intracerebellar tumor involving the left side chiefly	Died	Glioma of right side of cerebellum with cystic degeneration	Necropsy, March 26, 1923
3	D. B.	For observation	Intracranial neoplasm or inflammatory condition probably involving the cerebellum but not endangering the optic disks at this time	Increased intracranial pressure chiefly in the posterior fossa	Died	Papilloma of choroid plexus of fourth ventricle	Necropsy, May 10, 1923
4	M. G.	Brain tumor or cyst	Diagnosis between a slow growing cerebellar tumor or one of cystic formation in the posterior fossa	Intracerebellar lesion, more on left than on right side	Recovered	Gliomatous cyst of the right cerebellar hemisphere	Operation, June 30, 1923
5	H. H.	For observation	A case of infective or toxic nature, but at this time one cannot exclude the possibility of an intracranial neoplasm developing in the posterior fossa	Definite interference in pathway between vertical semicircular canals of left ear and nuclei innervating muscles producing rotary nystagmus	Died	Glioma of right side of cerebellum	Necropsy, Feb. 10, 1924
6	E. W.	For observation	Infectious or toxic lesion in the cerebellum, the right side more involved than the left	Increase of intracranial pressure due to subtentorial lesion	Died	Gliosarcoma between the two halves of the cerebellum	Necropsy, April 10, 1924
7	G. T.	Under observation for cerebral tumor	Infiltrating lesion of the posterior fossa	Posterior fossa lesion	Died	Gliosarcoma of pons and and medulla	Necropsy, Oct. 13, 1924

TABLE 2.—*Neuro-Otologic Data of Cases in Detail*

Case	Name of Case	Acoustic Labyrinth		No. of Ear Tests	Static Labyrinth																			
					Right Ear										Left Ear									
					Vertical Canals						Horizontal Canals				Vertical Canals						Horizontal Canals			
					Nystagmus				Past Pointing		Nystagmus			Past Pointing	Nystagmus			Past Pointing			Nystagmus			Past Pointing	
		Right	Left		Present or Absent	If Present, Normal or Abnormal	Vertigo	Nausea	Right Arm	Left Arm	Present or Absent	If Present, Normal or Abnormal	Vertigo	Nausea	Right Arm	Left Arm	Present or Absent	If Present, Normal or Abnormal	Vertigo	Nausea	Right Arm	Left Arm	Present or Absent	If Present, Normal or Abnormal	Vertigo	Nausea	Right Arm	Left Arm
1	W. L.	N	N	1	+	abn.+	..	..	..	..	+	N	..	..	..	..	+	abn.—	..	..	N	abn.	+	N	..	..	0	0
				2	+	N	..	..	..	..	+	N	..	..	..	..	+	abn.—	..	..	..	..	+	N	..	..	..	..
				3	+	abn.+	sl.	0	N	N	+	N	sl.	0	N	N	+	abn.—	0	0	abn.	abn.	+	N	0	0	N	0
		N	N	4	..	.....	..	..	..	..	..	..	..	..	..	..	+	abn.—	..	..	..	..	+	N	..	..	..	..
2	H. K.	N	N	1	+?	abn.—	0	0	0	0	+	N	sl.	0	sl.	sl.	0	.....	0	0	0	0	0	..	0	0	0	0
				2	+?	abn.—	0	0	0	0	+	N	sl.	0	sl.	sl.	0	.....	0	0	0	0	0	..	0	0	0	0
				3	..	.....	..	..	..	..	+	N	0	0	0	0	..	.....	..	..	..	..	0	0	0	0	0	0
				4	+	abn.—	0	0	0	0	+	N	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
3	D. B.	N	N	1	0	.....	..	..	..	..	+	N	..	..	..	..	0	.....	..	..	..	..	+	N	..	..	..	..
4	M. G.	N	N	1	+	abn.—	0	0	N	N	+	N	0	0	N	N	0	.....	0	0	0	0	+	N	sl.	0	N	0
5	H. H.	N	N	1	+	abn.—	..	..	..	..	+	N	..	..	..	..	0	.....	..	..	..	..	+	N	..	..	..	..
				2	+	abn.—	..	..	..	..	+	N	..	..	..	..	0	.....	..	..	..	..	+	N	..	..	..	..
6	E. W.	Dim.	Dim.	1 *	0	.....	..	..	..	..	+	N	..	..	N	0	0	.....	..	..	..	..	+	N	..	..	0	0
				2 †	0	.....	..	..	..	..	+	abn.+	..	..	N	N	..	.....	..	..	..	..	+	abn.+	..	..	N	N
				3	+	abn.—	0	..	+	0	+	N	0	..	0	0	+	abn.—	0	0	0	0	+	N	sl.	..	+	0
				4	+	abn.—	0	0	abn.	abn.	+	N	0	0	abn.	abn.	0	0	0	0	0	0	+	N	0	0	0	0
7	G. T.	N	N	1	..	.....	..	..	..	..	+	abn.—	0	0	..	..	..	.....	..	..	..	..	0	0	0	0	..	..

* Lumbar puncture performed, and 1½ hours allowed to elapse before second test was made.
† Interval of about 10 days; several lumbar punctures.

COMMENT

The first three tables which accompany this paper are arranged to correspond exactly with those of my first paper. This permits continuity of study.

Table 1 presents a general survey of the seven cases under discussion, given in chronologic order. The table shows that the otologic diagnosis of a subtentorial lesion was correctly made in each case. But it is exceedingly interesting to note that in three cases the actual lesion was on the side opposite to that diagnosed. This point will have further consideration. Attention is drawn to the first comment on Case 5.

In Table 2, the neuro-otologic data of the cases have been set down in graphic form for the convenience of the student.

TABLE 3.—*General Summary*

				Static Labyrinth, Ocular Response Only				
		Acoustic Labyrinth		Right		Left		
Case	Name	Right	Left	Vertical Canals	Horizontal Canals	Vertical Canals	Horizontal Canals	Actual Pathologic Lesion
1	W. L.	N	N	Abnormal	Normal	Abnormal	Normal	Diffuse cerebellar tumor spreading out into cerebellum on left side
2	H. K.	N	N	Abnormal	Normal	Absent	Absent	Glioma of cerebellum occupying entire ⅝ of posterior half of right cerebellar hemisphere with cystic degeneration in anterior half of right cerebellar hemisphere
3	D. B.	N	N	Absent	Normal	Absent	Normal	Papilloma of choroid plexus of fourth ventricle, no involvement whatever of cerebellum; tumor the size of a hen's egg
4	M. G.	N	N	Abnormal	Normal	Absent	Normal	Gliomatous cyst of right cerebellar hemisphere
5	H. H.	N	N	Abnormal	Normal	Absent	Normal	Large glioma almost filling the right half of the cerebellum
6	E. W.	Dim.	Dim.	Abnormal	Normal	Absent	Normal	Gliosarcoma between the two halves of the cerebellum
7	G. T.	N	N	.....	Abnormal	.....	Absent	Gliosarcoma of pons and medulla not involving cerebellum

Neuro-otologic examination in adults is extremely difficult. It is more so in children. Detailed hearing tests in children are notoriously prone to error. The rotation test has proved unsatisfactory. Past-pointing is always an exceedingly difficult phenomenon to interpret. Obviously the vertigo and nausea tests cannot always be adequately investigated. Complete neuro-otologic examination must be repeated to avoid error—but for practical purposes we must depend almost solely on the ocular responses to semicircular canal stimulation by the cold caloric test from which to make our deductions.

In order to present the essential facts, Tables 1, 2 and 3 have been prepared. The first three graphically summarize the data of the cases presented.

On the left side of Table 3 it will be observed that the cases are given in chronologic order. Three of these presented the same lesion—a glioma with cyst of the right half of the cerebellum—these are Cases 2, 4 and 5. Case 1 presented a diffuse cerebellar tumor, which did not come to necropsy. The remaining cases presented tumors which did not actually involve cerebellar tissue.

To emphasize these points the data of Table 3 have been rearranged in Table 4 thus:

Four of the tumors are actual degenerations of cerebellar tissue—Cases 1, 2, 4 and 5. Three tumors did not involve the cerebellar tissue proper—Cases 3, 6 and 7.

TABLE 4.—*General Summary, Re-Grouped According to Location of Lesion*

Case	Name	Location and Type of Lesion	Ocular Response			
			Right		Left	
			Vertical Canals	Horizontal Canals	Vertical Canals	Horizontal Canals
		A. Tumors Involving Cerebellar Substance				
2	H. K.	Glioma, with cystic degeneration involving almost entire right half of cerebellum	Abnormal delayed	N	0	0
4	M. G.		Abnormal delayed	N	0	N
5	H. H.		Abnormal delayed	N	0	N
1	W. L.	Cerebellar tumor involving left and possibly right half of cerebellum	Abnormal	N	Abnormal	N
		B. Tumors Not Involving Cerebellar Tissue Proper				
3	D. B.	Papilloma of choroid plexus of fourth ventricle	0	N	0	N
6	E. W.	Gliosarcoma between the cerebellar hemispheres	0	N	0	N
7	G. T.	Gliosarcoma of pons and medulla, not involving the cerebellum	..	Questionable response	..	0

In the first group, Case 1 was described by the physician as having a lesion which involved the left and possibly the right half of the cerebellum—it did not come to necropsy and is therefore placed by itself. The other three cases fortunately had almost identical lesions as may be seen from the photographs. In Case 2, Figures 1, 2 and 3 show that the tumor occupied almost the whole of the right half of the cerebellum. The tumor remained solid in the posterior pole, but had broken down to cyst formation in its anterior half. Figure 5 shows that in Case 5 the outer surface of the cerebellum presented no visible lesion, but Figure 6 shows that this tumor too occupied almost the whole of the right half of the cerebellum and was commencing to break down at its anterior pole. The remaining case has not come to necropsy, but a cyst was found to occupy the greater part of the right half of the cerebellum which was drained.

Here we have three almost identical pathologic lesions, and may therefore with advantage compare the neuro-otologic findings which they present (See Table 4).

The eye responses are almost identical. In each case those from the right vertical canals were abnormal in being diminished, those from the right horizontal canals were normal and the responses from the left vertical canals were absent. Thus far, three groups of findings agree absolutely. The fourth column alone shows differences. One patient (Case 2) was adequately examined—the horizontal ocular responses were definitely absent. When another patient (Case 4) was examined, subtentorial decompression had already been performed and the finding presumably altered. The examination of another patient (Case 5) took place six months before death, when it was possible that the tumor had not attained the dimensions shown in the photograph. Another patient (Case 4) is still alive, but at home at a considerable distance from Toronto. The occipital herniation is reported to be very large and information has been received that the cyst has already reformed. This patient may be expected to return for further examination and operation.

Eagleton was the first to describe and interpret the phenomenon of the absence of the excitability of the vertical canals of both ears to the cold caloric test as due to increased intracranial pressure.

It is reasonable to think that the otologic picture in subtentorial tumors of size may be the result of one or more of three factors: 1. A lesion involving the actual reflex arc. 2. Increased intracranial pressure. 3. Torsion.

It will be interesting at this point to speculate regarding the significance of the findings in Cases 2, 4 and 6 of Table 4. In all these cases the clinical findings on the one hand, and the necropsy findings on the other are identical. In each case, because the ocular response to ear stimulation was definitely less when the left ear was stimulated than when the right ear was stimulated, the lesion was judged to be on the left side. In each case the growth was found on the right side.

Let us begin by considering the question of a lesion of the reflex arc. Table 4 shows that the reflex arc most involved was that from the vertical canals of the left ear to the nerve nuclei of the ocular muscles—yet the pathologic lesion was on the right side in the cerebellar hemisphere. From this, the deduction would follow that the reflex arc from the vertical canals to the nerve nuclei of the eye muscles passes through the substance of the contralateral cerebellar hemisphere. But to the best of my knowledge there is no other clinical or histologic evidence to support this conclusion.

If pressure is the only factor, equally distributed, both sets of vertical canals should be equally affected. Table 4 shows that the responses from the vertical canals are unequally affected; on the one side they are totally obliterated, while on the other they are merely diminished.

Let us therefore consider that increased intracranial pressure in the posterior fossa is unequally distributed. In this case the pressure must be greater on the side which shows the more impaired ocular response. In all these cases the ocular response from the left ear was more impaired than the response from the right ear. Therefore in these cases the intracranial pressure was greater on the left side than on the right—that is—greater on the side opposite to the actual lesion.

That this is not an impossible suggestion will be evident from the abbreviated account of the findings at operation in Case 2. When the posterior surface of the cerebellum was symmetrically exposed, the surgeon demonstrated to those present that there was greater prominence in the left half of the cerebellum than in the right hemisphere and therefore supported my contention that the tumor was on the left side. It is only fair, however, to set over against this the observation at the operation on Case 4, in which the right half of the exposed cerebellum was found to bulge more than the left. One must appreciate the differences between the consistency of normal cerebellar tissue and the fluctuating character of cystic degeneration.

But I would here refer to Figures 3, 5 and 6. These show that the right side of the cerebellum—the side containing the tumor—was, in each case, considerably larger than the left—the unaffected—side; that the mass of the right cerebellum had pushed to the left of the midline and that there was dislocation of the brain stem. This brings up for consideration the third element, namely, torsion.

I, therefore, consider it probable that a unilateral cerebellar tumor of size produces tension by excessive pressure or torsion on the opposite side, and that it is this excessive pressure or torsion which is responsible for the greater impairment of the ocular reflex arc from the ear on the side opposite to the tumor.

The three cases I have cited are by no means unique. There are many other similar cases to be found in the literature of neuro-otologic examination. It is sufficient to point out that as long ago as 1912, W. P. Eagleton [2] reported:

> Both G. M. and J. J. H. presented a condition, namely, reduced reactibility to cold of the vestibular apparatus of the apparently unaffected side, the presence of which, in intracranial lesions, had not, so far as I know, been previously described.

2. Eagleton, W. P.: Tr. Am. Otol. Soc. (June) 1912.

In the second group, there are two cases of tumors which might almost be described as intracerebellar but which did not actually invade cerebellar tissue, namely, Cases 3 and 6. Figure 4 shows the lesion in Case 3. The specimen from Case 6 unfortunately came to grief. In this case it is not assured that the tumor did not involve some of the vermis, but the hemispheres were not involved.

It is not conceivable that these growths could directly involve any reflex arc. They could exert an effect by pressure alone. Because the tumors are essentially in the midline, the pressure exerted ought to have been distributed equally on the two sides. They present precisely the same otologic picture, in both cases a normal horizontal after-nystagmus but absolutely no rotary after-nystagmus.

Case 6 fortunately allowed interesting experimentation, the results of which can be seen in Table 2. This patient was tested twice after lumbar puncture had been performed. In the first instance not much fluid was removed, the puncture had resulted in headache and drowsiness, and otologic examination did not demonstrate any great divergence from the picture prior to puncture. Ten days later, after repeated spinal puncture, the boy was feeling much easier and otologic examination showed that a delayed rotary response could be obtained from the caloric test. It is reasonable to conclude that the alteration in finding was due to the diminution of pressure in the posterior fossa.

I, therefore, consider that these prove that excessive pressure in the posterior fossa when equally distributed to the two sides produces interference with vestibular function which is bilaterally symmetrical, and that the function of both vertical canal reflex arcs will be affected before those of either horizontal canal.

Figure 7 shows a comparatively normal cerebellum lying above and behind a tumor mass arising apparently in the pons. The tumor is roughly the size and shape of a medium sized hen's egg. It protrudes into what was formerly the fourth ventricle, but although the inferior surface of the cerebellum has been displaced upward for a considerable distance, there is no attachment to nor involvement of the cerebellum.

The tumor occupies so much of the upper portion of the pons that only very careful study by section will show which fiber tracts are involved. It can hardly be doubted that the reflex arcs from both sets of semicircular canals to the eye muscle nuclei are actually infiltrated or destroyed. In addition, its size has almost certainly caused pressure phenomena. It is therefore reasonable to suppose that the neuro-otologic picture in this case is a result of a combination of infiltration and pressure.

It would be well to speculate at another time as to why the hearing was normal in this case.

I am, therefore, of the opinion that factors 2 and 3, namely, increased intracranial pressure and torsion, are quite sufficient to account for the otologic pictures presented by the first six cases of this paper. Both factors 1 and 2 probably helped to produce the phenomena of Case 7.

The third generalization of my early paper stated that the extracerebellar tumors affected homolateral cochlear and vestibular function. As the last three cases each show an extracerebellar type of growth, my early generalization must be reworded.

CONCLUSIONS

In view of the information gathered from this and from the previous series of cases, I now submit that the evidence permits the following postulates.

1. Tumors of the frontal lobes do not interfere with cochlear or vestibular function. (I am aware that cases are described which dispute this contention—but I am arguing from the evidence supplied by my own cases.)

2. Subtentorial tumors which are completely outside the brain stem and the cerebellum, affect homolateral cochlear and vestibular function.

3. Subtentorial tumors which are in the midline and which do not involve cerebellar tissue do not affect cochlear function. They do interfere with vestibular function. The interference tends to be bilaterally symmetrical and the functions of both vertical canal reflex arcs are affected before those of either horizontal canal.

4. Unilateral intracerebellar tumors do not interfere with cochlear function. They do interfere with vestibular function. The function of the reflex arcs of the vertical canals will both be affected before those of the horizontal canals. The tumor will be found on the side opposite to the vertical canals with the function of which there is most interference.

A LATERAL SINUS PROBLEM AND ITS OPERATIVE SOLUTION

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Variations in the position of the lateral sinus are not infrequently met with in mastoid surgery, and usually cause no particular difficulty, especially when anticipated as the result of a good roentgenogram. In such instances, the operator guides his approach and makes his opening through the cortex with the position of the sinus in mind, thus avoiding the embarrassment and resulting handicap of opening into the sinus unexpectedly. Occasionally, however, the position of the lateral sinus is so abnormal and so complicates the usual operative procedure that special measures must be taken to deal with this condition in order to accomplish the proper drainage of the mastoid antrum and at the same time to avoid injury to the sinus.

PROCEDURE

I have recently operated on two patients, in each of whom the lateral sinus lay so far forward that its anterior edge almost approximated the posterior canal wall, leaving, as a result, none of the normal working space and cellular structure usually to be relied on between the sinus and the mastoid antrum. A word should be said in regard to the exact meaning of the term "posterior canal wall," since the existence of this structure as an actual wall with two sides naturally depends, so far as its posterior surface is concerned, on the creation of the operative cavity. The anterior surface is that facing the external canal and is a natural one; the other is operative and artificial. When the mastoid cavity is excavated and the posterior surface of the canal wall produced, much of the apparent relation of this surface to the sinus wall depends on how far posterior the excavation is. If it is directly over the sinus, it thus produces a posterior canal wall surface, which is, of course, close to the sinus and gives it the appearance of being in an abnormally anterior position. A truly displaced sinus can be considered to be present only when the mastoid excavation is so placed that a canal wall is thus created which is of essentially normal thickness (about an eighth of an inch), or so thick that further encroachment on it would endanger its integrity, causing a possible break in it with damage to the lining of the external meatus and a subsequent atresia of the canal. When the mastoid excavation is thus placed and enlarged, and at its base a sinus is uncovered which then has its anterior edge almost approximating the posterior surface of a "normal bony canal wall," we have an

unusual and complicating situation which calls for special operative caution, and in my case the modification in the usual technic of the simple mastoid operation which is here described. Unfortunately, one is not always sure which is the best way to meet such unexpected conditions, though the recurrence of the same abnormality finds one better able to solve the problem.

The following is an account of this condition as first encountered by me.

REPORT OF CASE

CASE 1.—*History.*—A woman, Jewish, aged 50, suffering from diabetes, entered the hospital complaining of pain in, and discharge from, the right ear, which had lasted intermittently for two weeks. On admission, the drum was incised for more adequate drainage, following which the pain was less marked and the discharge more profuse and mucoid in character. For the next two days the temperature ranged between 100 and 101 F., there was slight mastoid tenderness on pressure over the tip, and edema of the posterior canal wall began to develop. With a white count of 20,000, an increasing thickness in discharge, and the distinct impression that the patient was not improving, it was deemed advisable to open the mastoid.

Operation.—This was performed largely under gas-oxygen anesthesia, to which was added a small amount of ether. On opening the mastoid cortex, the lateral sinus was immediately uncovered and was found to be lying in a wholly abnormal position, with its anterior edge directly approximating the posterior canal wall. The mastoid cells were hemorrhagic and edematous but there was no actual bone destruction and no free pus. A small hole made in the lateral sinus caused momentary bleeding which was easily controlled with iodoform wick packing. An attempt to enter the mastoid antrum was begun but was rendered extremely difficult owing to the proximity of the sinus and canal wall. By gently pushing the sinus backward, a space was disclosed into which a curet was introduced and carefully worked forward toward the mastoid antrum. The bone at this point was extremely dense and it required considerable effort to penetrate into what was felt to be the antrum. Two iodoform packs were left in the wound, one leading to the antral opening and the other to the point of entrance into the lateral sinus. The wound was closed with interrupted chromic catgut suture.

During the next two days the patient had a low grade elevation of temperature, she complained a good deal of pain in the region of the mastoid and seemed, on the whole, not to be doing well. There was a little discharge from the middle ear. On the following day the white count rose to 40,000, the temperature was 102 F., and the general appearance was worse. Careful examination of the blood excluded diabetic acidosis as a cause of the symptoms, and a chest examination showed no pneumonia. In twenty-four hours, signs of meningitis developed, lumbar puncture revealed a cloudy fluid, and on the following day the patient died. Permission for necropsy was refused.

COMMENT

The fatal outcome of this case, in view of the great difficulty caused by the position of the sinus, has led me to considerable speculation as to the cause of the meningitis. The patient had diabetes and so of course was not a normal risk, her tissues in all probability being less resistant to infection, which was initially of a more than usually virulent character. Nevertheless, the question arose as to whether the efforts to dis-

place the sinus backward, in order to secure an approach to the antrum, still without damaging the posterior canal wall, had not in some way made a small rent in the dura or an abrasion through which the infection made its way. No necropsy was secured so that the question remained unsettled. To show that in such a case an approach to the antrum from behind by attempting to displace the sinus backward (and it is certainly capable of a certain amount of such displacement) exposes the dura to the risk of trauma, I have prepared a series of somewhat diagrammatic sketches based on anatomic cross sections of the temporal bone. These are intended to show the coronal relationships of the sinus and antrum as they exist, both normally and with this variation.

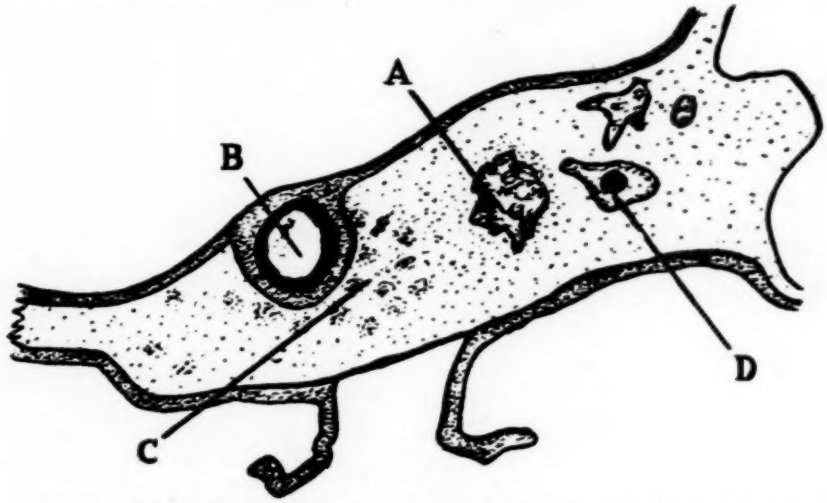

Fig. 1.—The definite cellular space between the sinus and the posterior wall of the antrum. *a*, antrum; *b*, sinus; *c*, mastoid cells; *d*, middle ear.

Figure 1 shows the definite cellular space between the sinus and the posterior wall of the antrum, through which the opening into the latter is usually easily made without the sinus being exposed or offering the least hindrance.

Figure 2 presents an entirely different and more serious relationship, in which there is only the narrowest of spaces between the antrum and the sinus. Here it will be readily appreciated that any marked attempt to displace the sinus backward will strip its dural covering and attachment from the bone encasing the antral cavity, thus exposing the dura in a most unusual way. A safer, though possibly less classical, approach to the antrum must be found in such a situation, the appearance of which at actual operation is represented in Figure 3.

Here the mastoid excavation has been performed, the sinus has been either intentionally or unexpectedly exposed and has been found to lie close to the newly created "posterior canal wall," thus hindering very

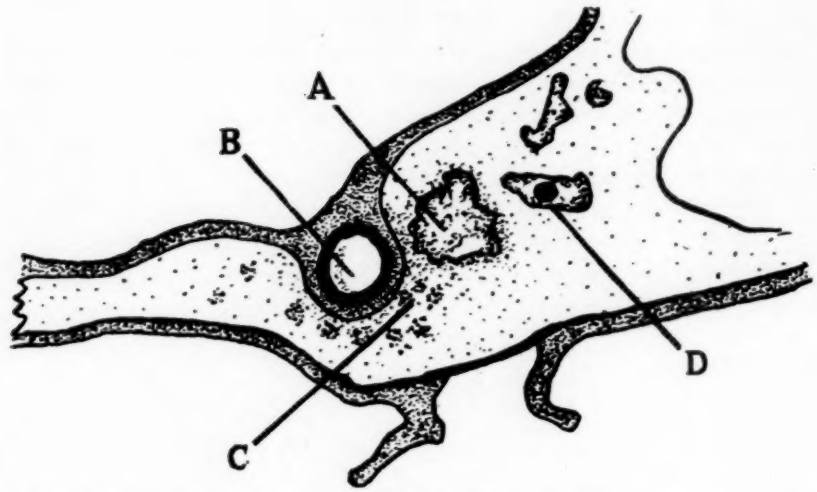

Fig. 2.—The narrow space between the antrum and the sinus. *a*, antrum; *b*, sinus; *c*, mastoid cells; *d*, middle ear.

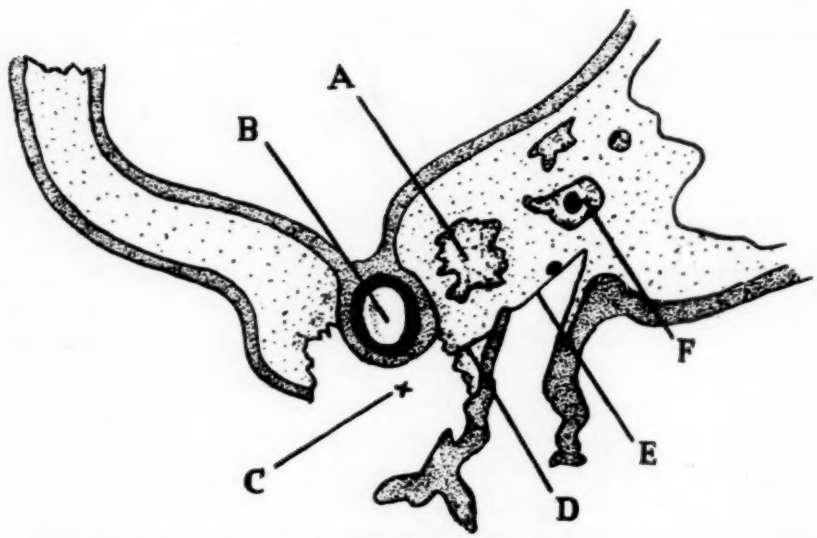

Fig. 3.—After the mastoid excavation. *a*, antrum; *b*, sinus; *c*, operative cavity; *d*, line of approach in postcanal wall to antrum; *e*, drum membrane; *f*, middle ear.

effectually a normal approach to the antrum. The contrast to this is shown in Figure 4, the normal operative picture, showing an abundance of room through which to enter the antrum from behind.

Further, I have attempted to portray the appearance of these structures as seen at actual operation by Figures 5 and 6, drawn to represent the normal (Fig. 5) and anterior (Fig. 6) positions of the sinus when exposed.

In an effort to meet the variations of relationship and to avoid any risk to the dura, in my second case I carried out a procedure the rationale of which can best be understood from a study of Figure 3. Here it

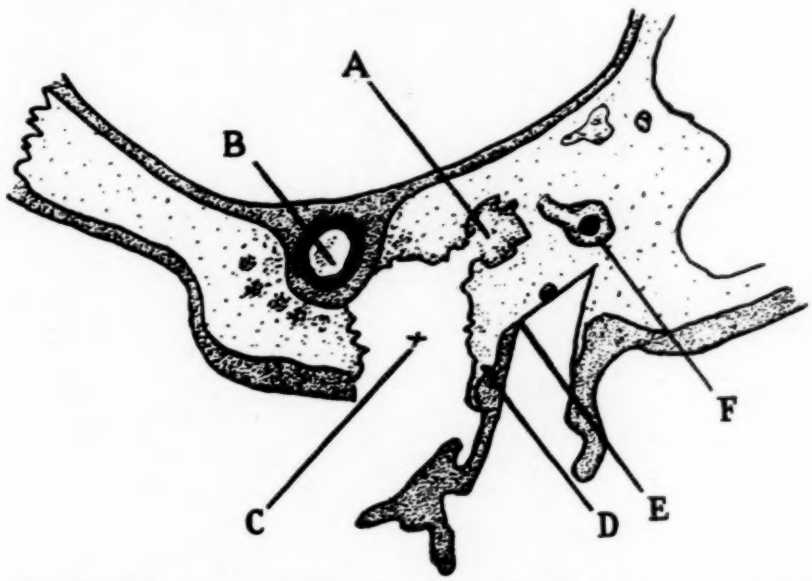

Fig. 4.—The normal operative picture. *a*, antrum; *b*, sinus; *c*, operative cavity; *d*, postcanal wall; *e*, drum membrane; *f*, middle ear.

will be seen that the bony canal wall becomes somewhat wider as it approaches the antrum, to the lateral surface of which it leads directly. It seems that if the sinus is to remain undisturbed, the only logical approach to the antrum must be from the side instead of, as ordinarily, from behind. The only difficulty which such a lateral approach offers would be the initial engagement of a curet in the canal wall, since the latter tapers off to a thin edge which allows no point of purchase. To overcome this, I simply removed sufficient of the outer portion of the canal wall to offer a transverse surface into which the curet could be introduced, whence it can readily be carried inward directly through the lateral wall of the antrum. This procedure is in some ways analogous to the complete removal of the posterior canal wall in the radical mastoid operation, but of course is by no means as extensive. It is, perhaps,

Fig. 5.—Normal structure, as seen at operation.

Fig. 6.—Abnormal structure, anterior position.

open to the criticism that in creating this canal wall surface, the soft portion of the canal must be separated sufficiently to expose the bony part and thus may give rise to a later narrowing of the canal. This did not occur in the second case, and if the separation is not carried too far it is unlikely to result in appreciable stenosis.

Figure 7 shows the actual appearance after the necessary amount of bony canal wall has been removed. A flat surface has been created, in the center of which is shown the opening made by a careful introduction of a curet that is carried inward until it penetrates the side wall of the antrum. Once this result has been accomplished, the passage to the

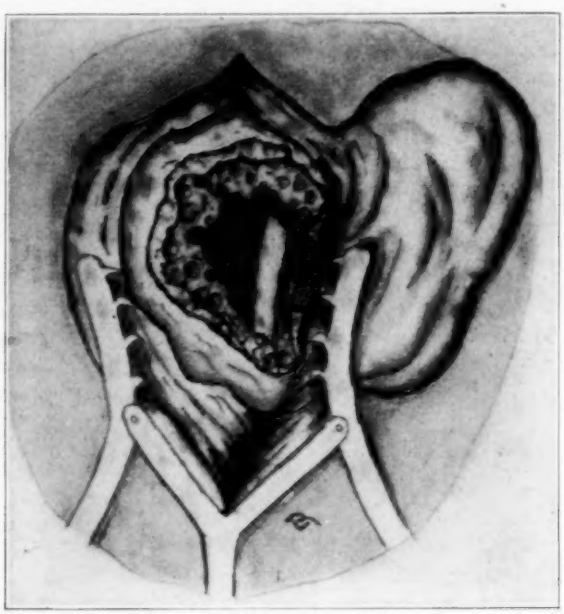

Fig. 7.—The actual appearance of the canal after part of the canal wall has been removed.

antrum can then be enlarged to the required degree by drawing the curet outward from within, with its cutting edge turned posteriorly toward the sinus, where there is still a definite although abnormally narrow partition. Care of course must be taken that this partition is not broken through and damage done to the sinus, but if judicially carried out this procedure is far less blind and therefore far safer than to attempt entrance to the antrum from behind. The satisfactoriness of this procedure was clearly demonstrated in my second case.

Case 2.—A young girl entered the hospital with a history of pain in the right ear, together with vomiting and dizziness for one week. There was a mucopurulent discharge from the canal, with some edema of the latter and slight mastoid tenderness.

On operation, after opening the cortex, the lateral sinus was uncovered and was found lying close to the posterior canal wall, thus leaving no space through which to effect a normal approach to the antrum. The moment the sinus was pushed posteriorly, there was a gush of pus from a perisinus abscess. The posterior canal was cut down to a sufficiently broad surface to permit the use of small curet to establish a direct entrance laterally to the antrum, which was found to be filled with pus. An iodoform wick was led directly to the antrum and the wound closed with interrupted catgut suture. The middle ear was dry the next day and an absolutely uneventful convalescence followed.

CONCLUSIONS

The question whether this lateral approach to the antrum gives better drainage and a quicker convalescence than the normal posterior approach can scarcely be decided by two cases, any more than can the presence of a perisinus abscess be attributable to the unusual proximity of the sinus to the antrum. Both are possibilities.

Two other cases of this same embarrassing situation have come to my knowledge: in one, the operator was forced to leave the antrum unopened for fear of damage to the lateral sinus, and in the other secured only a minute and inadequate opening. In the latter, a second operation was required, at which time an extensive thrombosis of the sinus was found. Jugular ligation, evacuation of the thrombus, and entrance to the antrum in the manner before described resulted in speedy recovery without incident.

This sinus variation has undoubtedly been met by other men who have solved the problem in various ways. I found this solution one which has given me an excellent result.

CORRECTION OF HUMP OR SADDLE BRIDGE NOSE

SIMPLIFIED METHOD

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FRANKLIN, PA.

The method that I report is, I believe, an original surgical procedure for the correction of hump and saddle bridge noses and of some other nasal deformities. It is one which I have practiced for the last six years. I described its technic first while on the board the S. S. *Rotterdam* on June 29, 1922, to Dr. George W. Mackenzie, of Philadelphia, and a group of eye, ear, nose and throat specialists which he conducted to Vienna for a course of study. On July 18, 1924, I again described the operative procedure at a meeting of the Venango County Medical Society of Pennsylvania.

I outline this operation because of its facility and safety, for the greatest deterrent to the correction of external nasal deformities is the difficulty of reaching the field without causing infection or scar formation. The removal of the enlargement in hump nose, or the placement of a cartilage or bone cartilage graft in saddle nose, is especially facilitated by the method to be described.

METHOD

When a general anesthetic is administered, ether by insufflation is the method of choice. When possible, I prefer the use of local anesthesia with freshly prepared 1 per cent. procain in physiologic sodium chlorid solution. The face is washed with warm water and soap, followed by the use of alcohol and ether. The hair is clipped from the interior of the nostrils, and each vestibule and columella is cleansed with surgical solution of chlorinated soda. Nasal passages up to the vestibular junction are packed with half inch (0.12 cm.) strips of dry sterile gauze, over which plugs of cotton wrung out of saline solution are placed to prevent more effectually the oozing of blood into the throat.

A traverse incision is now made, with a small, sharp scalpel, through the skin of the anterior part of the columella at its junction with the under surface of the nasal tip, and prolonged on each side along the anterior border of the naris for about one-quarter inch (0.6 cm.). The skin is dissected from the tissues beneath, the flap is raised with a double tenaculum so as not to crush it, a pair of small Mayo or similar scissors with blunt but narrow points are substituted for the scalpel, and the skin is easily and quickly separated over the

tip, bridge and sides of the nose, if desired, by alternately opening and closing the scissors.

For correction of hump nose, all loose tissue is freed and the periosteum is separated to each side with an elevator; then the hump is removed with a chisel, small saw or spoke shave, according to the

Fig. 1. (Case 1).—Before operation.

Fig. 2 (Case 1).—Four weeks after costal cartilage transplant.

will of the operator. A Joseph rasp is then used to smooth the surface. Bleeding is controlled by applying firm pressure from three to five minutes. The plugs are removed from the nostril; stitches are taken with medium sized dermal suture, placing one suture in the center of the columella, and one in the border of each anterior naris. The sutures should be placed close to the edges of the skin and tied with

barely sufficient tension to draw the skin edges together. Care should be exercised in approximating the skin edges accurately, as an uneven union will increase the tendency to scar formation. However, if a scar does form, it will not be observed unless the under surface of the nose is brought into view. The stitches should be removed on the

Fig. 3 (Case 2).—Before operation.

Fig. 4 (Case 2).—Three weeks after operation.

third day. A pressure dressing, consisting of a piece of properly trimmed dental wax, is placed in warm water to soften it, after which it is molded over the bridge and allowed to harden. Adhesive strips are used to attach this dressing in place, and it is left on for forty-eight hours. Sterile petrolatum or albolene may be applied to the skin incision to prevent the formation of scabs.

The same technic may be followed in forming a bed for the insertion of cartilage, or bone cartilage graft, for the correction of saddle bridge nose. A hump on the side of the bridge may be removed, or lateral depressions filled in with cartilage by this route. I believe this subcutaneous route offers a method which is of more value than any other because:

Fig. 5.—Scissors inserted beneath flap and separating skin.

Fig. 6.—Skin incision at anterior part of columella.

1. If a scar forms, it is not observed under ordinary circumstances.
2. Drainage is easily established, if required.
3. Approach to the field for all bridge operations is simplified.
4. There is less danger of infection and less trauma than by the internal nasal route, as it is necessary to raise the skin only over the bridge and not from the side of the nose in correcting hump or saddle nose.

Since this paper was written, my attention has been called to an article by Dr. Samuel E. Roberts of Kansas City, which appeared in the December, 1924, number of the *Annals of Otology, Rhinology and Laryngology,* entitled: "Nasal Hump—A Simplified External Operation," in which he describes an incision for the operation nearly identical with mine. His technic was evidently developed at a later date, without previous knowledge of my work.

DYNAMIC STUDIES ON THE CEREBROSPINAL FLUID IN THE DIFFERENTIAL DIAGNOSIS OF LATERAL SINUS THROMBOSIS *

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AND
JAMES B. AYER, M.D.
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Increased intracranial pressure is normally propagated throughout the cerebrospinal fluid system and may be measured by a manometer employed in connection with lumbar puncture. Compression of the internal jugular veins causes increased intracranial pressure with immediate rise in spinal fluid pressure.

These two statements are facts of considerable importance. It is now generally considered that absence of rise in fluid pressure on jugular compression (positive Queckenstedt [1] sign) indicates spinal subarachnoid block, a most important and early sign in spinal cord tumor. More recently, it has been shown that block may also occur and be detected in a similar manner in the presence of tumor of the cerebellar fossa.[2]

In both of these conditions, the evidence on which a diagnosis of block rests is absence of rise in pressure below the level of obstruction, the increased intracranial pressure being assumed in single puncture below, or proved by two punctures, one above and one below the level of obstruction.[3]

It may be safely said that the criteria on which these tests depend and the results of the tests have been for the most part dependable. So much so, in fact, that the effect of jugular compression on spinal fluid pressure now forms one of the routine tests in diagnostic lumbar puncture.

It is now proposed to use this test in the diagnosis of lateral sinus thrombosis. While the criterion on which a diagnosis of sinus throm-

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* From the Massachusetts Eye and Ear Infirmary.

1. Queckenstedt: Ztschr. f. Nervenheilk. **55**:325, 1916.

2. Fremont-Smith, F., and Hodgson, J. S.: Combined Ventricular and Lumbar Puncture in the Diagnosis of Brain Tumor, Arch. Neurol. & Psychiat. **13**:278 (Feb.) 1925.

3. Ayer, J. B.: Puncture of the Cisterna Magna, Arch. Neurol. & Psychiat. **4**:529 (Nov.) 1920; Spinal Subarachnoid Block as Determined by Combined Cistern and Lumbar Puncture With Special Reference to the Early Diagnosis of Cord Tumor, ibid. **7**:38 (Jan.) 1922.

bosis is based is the same as that of subarachnoid block, namely, absence of rise in pressure in the spinal fluid manometer, it will be seen that the mechanism by which this is shown is quite different. Instead of an increased head of fluid which cannot be transmitted because of obstruction, there is here no elevation of pressure at its source, because of venous obliteration. Also, we are here concerned with a careful comparison of the effect of pressure on each vein separately, not merely with the effect of simultaneous compression of both internal jugular veins, as in the diagnosis of cord tumor.

SINUS THROMBOSIS TEST

The test for sinus thrombosis as we have used it, is as follows: With the patient in the lateral position, lumbar puncture is performed, and the fluid is allowed to run into a glass manometer of 2 mm. bore. The initial pressure reading is noted; also the presence of pulse and respiratory oscillations as evidence of patency of the manometric system. Now, without in any way disturbing the patient, an assistant gently presses on one side of the neck between the larynx and the sternocleidomastoid muscle until he feels a strong carotid arterial pulsation. During the compression, the operator watches the rapidity of rise of the fluid column in the manometer, the promptness of its beginning and the full height to which it attains, and, on release of jugular compression, the rapidity of drop in pressure. The procedure is now repeated on the opposite side of the neck, and then, for comparison, both sides of the neck are pressed simultaneously.

In a typical case of lateral sinus thrombosis, there is a prompt and rapid rise in fluid pressure to twice or three times the initial reading when the internal jugular vein draining the normal sinus is compressed. This pressure rise is maximal, being equivalent to the pressure attained when both jugular veins are compressed.

Pressure over the vein draining the thrombosed lateral sinus causes either no rise or, more commonly, a slow rise of only from 10 to 20 mm. in the manometer.

These findings are characteristic of complete obliteration of the sinus. Partial obstruction from mural thrombosis naturally gives less striking results, yet is of value when correlated with the clinical findings.

Before drawing conclusions from such tests, we may well consider some of the pitfalls of the technic. The first, second and third (mentioned below) are the result of study of this test in the routine study of over 3,000 punctures in cases in the neurologic clinic. The fourth and fifth depend on a study of seventy-five cases from the same source.

1. Absence of rise in fluid pressure or very slight rise is occasionally noted in patients with no obstruction either in venous or in subarachnoid fluid systems when the cerebrospinal fluid is under low tension. This can easily be proved in a given case by injecting from 10 to 20 c.c. of physiologic sodium chlorid solution, on which dynamic tests will appear normal.

2. In certain persons with thick necks, it may be extremely difficult to locate or properly compress the veins of the neck, and in such cases an unsatisfactory response is occasionally met with when no question of sinus disease or subarachnoid block is entertained.

3. An abnormal rise in fluid pressure may result from carelessness in performing the test, leading to extraneous acts on the part of the patient. If the patient coughs, holds his breath, grunts or even moves the head or body, a prompt rise in pressure will be noted under normal or abnormal conditions, thus vitiating any record.

4. Normal difference on the two sides. The foregoing pitfalls concern bilateral as well as unilateral venous compression. A group of unselected patients in the neurologic clinic were examined with a view to determining the uniformity in response to jugular compression on the two sides. The following conclusions are justified from this study: (1) There is often a marked difference in the height of the pressure reading following compression of each internal jugular vein separately. However, a difference of over 50 mm. is unusual and over 100 mm. exceptional. (2) Given a normal initial spinal fluid pressure (150 mm.), the rise on jugular compression of one side usually will be ample, seldom less than 50 mm., more likely over 100 mm. (3) The rise in fluid pressure appears to be somewhat less when the vein on the dependent side is compressed. It is likely that this is an error in technic due to difficulty in reaching this vein rather than an inherent difference in physiology.

5. Anatomic variation in the size of the lateral sinuses must be admitted, although a demonstrable difference in the size of the two lateral sinuses is unusual.[4] This difference is occasionally observed, and in our experience with this test one example of such discrepancy occurred. We must, therefore, admit a certain irregularity in the anatomic disposition of the tributaries of the internal jugular vein, variations of the facial vein being of greatest significance in this test. It is probable that the slight rise frequently observed on compression of the jugular vein on the side of complete sinus thrombosis is to be explained by coincident compression causing stasis in the ophthalmic venous system.

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4. Personal communication by Dr. H. P. Mosher.

DANGERS

The possibility of two known dangers must be admitted in the use of this test. We refer to (1) sudden death from the presence of subtentorial abscess or tumor following lumbar puncture, and (2) the precipitation of acute meningitis.

The first danger may almost be eliminated by a careful preliminary examination of the patient. If the neurologic examination suggests the presence of abscess or tumor, but especially if choked disks are found, the well known danger of medullary paralysis following lumbar puncture must be entertained. In such patients the spinal fluid tests should not be attempted.

The second possible danger relates to the liberation of organisms from an area of localized infection or from the blood stream. The former appears to us to be unlikely unless large amounts of fluids are withdrawn. But the latter danger rests on experimental evidence in which it was shown that in the presence of blood infection, passage of organisms from vessels to meninges may be facilitated by withdrawal of cerebrospinal fluid, by cerebral venous congestion.[5] Although recognizing this as a biologic principle, we have so far failed to note this serious coincidence clinically. Further, we believe that this danger is not great because we seldom have present in man the setting required for the experimental production of meningitis, namely, septicemia with a sufficient number of organisms or of proper virulence; nor do we reduce fluid pressure so greatly or congest cerebral vessels so long as in the experiments in which meningitis was precipitated from septicemia.

The results of a four months' investigation of the dynamics of the cerebrospinal fluid as applied in the differential diagnosis of lateral sinus thrombosis are here presented.

Heretofore, given the symptoms of septicemia associated with aural infection, the diagnosis of lateral sinus thrombosis—mural or complete—has been made by the process of exclusion and actual investigation of the lumen of the sinus or bulb itself.

We feel justified, after careful analysis of these cases, in stating that a definite, dependable preoperative diagnosis—positive or negative—may be made by means of the technic as outlined.

Diagnostic classifications:

1. Complete obstruction—obliteration of the lumen of the lateral sinus or the jugular bulb or of both.

2. Incomplete obstruction—mural thrombosis.

3. Negative—no obstruction to venous outflow.

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5. Weed, L. H.; Wegeforth, P.; Ayer, J. B., and Felton, L. D.; Monograph, Rockefeller Institute, No. 12, pp. 61 and 84, 1920.

REPORT OF CASES

CASE 1.—B. K., aged 14 years, in whom, following a mastoid operation and ligation of the left jugular vein (internal), meningeal symptoms occurred. Lumbar puncture was made for confirmation of diagnosis. Initial pressure of the spinal fluid was 160 mm. of cloudy fluid. At the suggestion of Dr. Ayer, we applied pressure to the left jugular vein (ligated) with no evident change in the spinal fluid pressure as indicated on the Ayer manometer. Slight pressure applied to the right internal jugular caused an immediate rapid rise of over 100 mm., accompanied by severe headache; removal of pressure resulted in immediate and rapid fall of the fluid pressure to initial pressure point with immediate relief of the headache.

During numerous subsequent lumbar punctures, required to relieve pressure, the previous observations were substantiated.

The increase in spinal pressure is relative, as shown in this case and subsequently proved on others; the relative rise varies in ratio to the initial pressure, which is the level in the manometer in which the spinal fluid first finds its own relative level; an allowance of from 2 to 10 mm. is allowed for pulse and respiratory oscillations.

This case was our incentive to further investigations.

CASE 2.—Seven days following a paracentesis on the right in this patient, there was a moderate mucoid discharge, a normal temperature, no pain and no evident symptoms of mastoid involvement. On the seventh day there was a sudden severe chill, the temperature rose to 105 F., and was associated with marked general prostration. Chills occurred at intervals of a few hours.

Diagnosis (provisional): Lateral sinus infection.

Lumbar Puncture: initial pressure, 220; compression of right internal jugular, 290 mm. (rise of 30 mm.); compression of left internal jugular, 450 mm. (rise of 220 mm.); rise on left very rapid, fall on left very rapid.

Operation revealed large pneumatic cells, showing no gross evidence of infection and no free pus. On exposure of the lateral sinus, a perisinus abscess with pus under pressure was exposed; there was a large necrotic perforation through the wall of the sinus and complete thrombosis of the lateral sinus from the posterior to the superior petrosal sinus to and involving the jugular bulb.

CASE 3.—J. F., aged 11 years, was admitted to hospital and a double mastoid operation was performed on Feb. 3, 1925. As there was a history of an irregular temperature for several days, both sinuses were exposed and found to be apparently normal.

Manometer Test.—Spinal fluid clear, 2 cells; initial pressure, 300 mm. high; right jugular compression, 150 mm. rise—rapid; left jugular compression, 150 mm. rise—rapid.

Compression of the lateral sinuses gave the same result.

Compression of both jugulars forced the fluid out of the manometer. Evidently there was no obstruction to venous circulation.

February 10, the septic symptoms receded after the operation. The temperature rose again with the meningeal symptoms; the spinal fluid showed a cell count of 2,100. The manometer test was unchanged. From 35 to 40 c.c. of fluid was drawn off.

Twenty-four hours later, owing to repeated chills and elevation of temperature to 105 F., further investigation of the lateral sinuses was imperative.

Lumbar puncture yielded a slightly cloudy fluid; the initial pressure was 100 mm. On right jugular compression there was no rise but pulsation was present. On left jugular compression, there was 200 mm. rise and compression was discontinued owing to severe headache. The right internal jugular was ligated. The lateral sinus when opened showed complete thrombosis of the bulb.

Diagnosis.—Evident sinus infection with apparent formation of complete thrombosis during an interval of twenty-four hours.

CASE 4.—This patient, aged 10 years, on Dec. 16, 1924, had a double mastoid operation. A pure culture of Klebs-Loeffler bacilli was obtained. December 26, a septic temperature, with evidence of meningeal irritation, left a facial paresis for two days.

The clinical diagnosis was a lateral sinus infection. Since both mastoids were infected, the problem arose of deciding which mastoid was affected.

Manometer Test.—Initial pressure, 220; left jugular compression, slow rise and fall of 40 mm.; right jugular compression, rapid rise and fall of 130 mm.

Provisional Diagnosis.—Mural thrombosis of left lateral sinus.

Operation.—Ligation of left internal jugular, with a demonstration of almost complete mural thrombosis in the lateral sinus. There was immediate recession of septic symptoms.

CASE 5.—W. T., a boy, aged 10 years.

History.—Three weeks prior to examination the patient had a bad cold; it was said he had pneumonia. The illness began as an earache in the left ear, with impaired hearing. The pain was relieved in from three to four days after spontaneous rupture of the drum. The discharge lasted nearly one week. About two weeks prior to examination, a slight swelling which had become very tender began below the right ear and had been getting more marked. The patient was confined to bed for two weeks with headache and an elevation in temperature before entrance to the hospital. The provisional diagnosis was meningitis.

We saw the patient in consultation with otologists. The left drum membrane was apparently thickened and slightly reddened. Paracentesis resulted in a dry tap; the middle ear was normal. The right middle ear also was normal. There was no clinical evidence of mastoiditis in either ear.

In view of the history of acute otitis media three weeks previously, with discharge for three or four days, the possibility of a jugular bulb thrombosis on the left side was considered. Infection of the right lateral sinus was not considered since there had been no history of infection on that side.

Neurologic examination including the manometer test was as follows:

There was no cranial nerve palsy. The left side of the face was better than the right, but the patient's mother stated that this was natural. The patient still had a bilateral Kernig sign, but it was possibly less marked than the previous day. Babinski's sign was positive on the right, and had been so both at the hospital and at the patient's home. The neck could be flexed well considering the swelling on the right. The patient appeared a little brighter. The fundi were not examined.

Lumbar puncture was made by Dr. Motley. The initial pressure was 130 mm.; the pulse and respiration were normal. Dr. Fremont-Smith made this note:

"The jugular compression on the left showed a prompt rise to over 300 mm. with only slight pressure; a prompt fall on pressure release was observed. This rise was more marked than I have ever seen from unilateral pressure but is quite similar to the rise obtained on the normal side when the jugular on the other side had been tied. This finding was confirmed by five separate compressions. The patient did not complain of pain or become tense when the left side of the neck was compressed.

"The jugular compression on the right was painful to the patient. He became tense and cried on each occasion except the last. Gentle pressure gave no rise, more marked pressure gave rise to 150 or 160 mm., but this was always accompanied with tenseness and an outcry on the part of the patient. On marked pressure, the patient complained loudly and there was fairly prompt rise which never got above 220 or 230 mm. and always tended to come down if he stopped crying. This pressure was greater than used on the left at any time. After release of pressure on the right, the fluid remained at 220 until the patient stopped crying, then it gradually fell.

"The difference between the response to jugular compression on the two sides was striking. They can best be explained by a condition causing nearly all of the venous return from the cranium through the left internal jugular vein. I believe this is additional evidence of obstruction of the right lateral sinus or jugular bulb."

Operation revealed a completely broken down thrombus, involving the lateral sinus and jugular bulb, and extending downward in the jugular vein on the right side.

Remarks.—Clinically, we would naturally consider that the thrombosis would be on the left side, and undoubtedly without the manometer findings that side would have been first explored.

CASE 6.—W. G., aged 16, was admitted because of acute mastoiditis on the left side.

History.—There had been a discharge in the left ear for two weeks, postaural tenderness for three days, and an irregular temperature for three days. On the morning of admission the patient had a severe chill lasting for a half hour. The blood culture was positive; there was a history of chills and high irregular temperature for three days.

Diagnosis.—Left acute mastoiditis with lateral sinus infection.

The manometer test demonstrated no interference with the venous drainage on either side, the pressure being equal on compression of the alternate internal jugulars. A simple mastoid operation was performed. Three days later definite erysipelas of the face appeared.

Remarks.—Although the clinical diagnosis of lateral sinus infection had been made, owing to the negative manometer test, the lateral sinus was not interfered with. Justification for this procedure is shown in the presence of the definite erysipelas within seventy-two hours, thus accounting for temperature, chills and positive blood culture.

CASE 7.—A. B., aged 19.

History.—Right otitis media for three weeks, high irregular temperature and severe chills, accompanied by nausea and headache, for four days.

Roentgenogram showed complete destruction of the right mastoid.

Provisional Diagnosis.—Acute mastoiditis on the right side, with a question of lateral sinus infection.

Manometer test showed an initial pressure of 190 mm. Compression of left jugular showed repeated rise and fall of 100 mm.; of right jugular, repeated rise and fall of 110 mm., thus ruling out any interference with the venous drainage on both sides. A simple mastoid operation was performed. The patient made an uninterrupted recovery.

These few cases are selected as typical from a series of twenty-two. In every instance to date, the diagnosis as influenced by dynamic tests has proved to be correct.

CONCLUSIONS

1. When obstruction of lateral sinus, jugular bulb, or internal jugular vein occurs, block may be demonstrated by dynamic studies on the cerebrospinal fluid.

2. The manometric studies on the fluid have proved reliable in the case of complete block and highly suggestive in the case of incomplete block, not only in determining the presence of thrombosis but also as criteria as to which side is involved.

3. Absence of block as determined by spinal fluid tests is also of value in the differential diagnosis of sinus thrombosis.

4. The test has proved of special value in cases presenting double mastoiditis developing symptoms of lateral sinus thrombosis.

5. While theoretic dangers must be admitted in carrying out this procedure, in twenty-two cases we have not seen evidence of ill effect from the technic.

Clinical Notes

A NEW VALVULAR TRACHEAL CANNULA*

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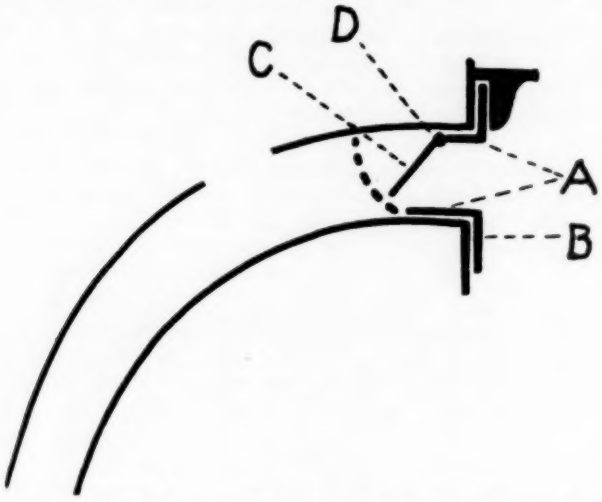
CINCINNATI

A patient who is compelled to wear the ordinary tracheal cannula is much embarrassed in his phonation, owing to the escape of expired air through the cannula instead of through the larynx. Normal coughing also is interfered with. Therefore, the patient usually places his finger over the cannula when he wishes to speak or to expectorate.

In order to overcome these defects, I have had a valve constructed which fits into the ordinary tracheal cannula. It is constructed on the principle of a swinging check valve which permits the free inflow of air during inspiration



Tracheal cannula containing valve. *A*, middle tube; *B*, neck plate; *C*, check valve; *D*, hinge.

but which closes during expiration. The appliance consists of a thin piece of metal tubing, *A*, of the exact diameter of the lumen of the tracheal cannula. The outer end of it is provided with a plate, *B*, which fits against the neck plate of the tracheal cannula. The inner end of *A* is cut off obliquely from above downward and is covered by a metal check valve, *C*, which rotates up and down on a wire hinge, *D*. When inserted into the tracheal cannula, the shutter is elevated during inspiration by the inflowing current of air, but is closed during expiration by the outflowing air current and the weight of the valve. Practically all of the expired air is thus forced between the vocal cords, and phonation is greatly aided.

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* Presented before the Section on Laryngology, Otology and Rhinology at the Seventy-Sixth Annual Session of the American Medical Association, Atlantic City, May, 1925.

* Read before the Middle Section Meeting of the American Oto-Rhino-Laryngological Society, Lafayette, Ind., Feb. 23, 1925.

The valve cannula may be employed in all cases in which the outflow of air through the larynx is not too greatly obstructed, and is especially useful in cases of bilateral paralysis of the vocal cords. In patients with excessive secretions or in children, its employment must be carefully supervised. The valve functions both in the upright and in the recumbent posture. At bedtime, the ordinary inner tube may be substituted for the valve. The valve should be removed, cleaned and lubricated with vaseline or oil whenever necessary. The outer cannula should be fenestrated to aid phonation.

Four other devices have been designed for the same purpose. One is the ball-valve cannula of Bleiweis.[1] Elsberg[2] constructed a similar cannula, and also a horizontal cannula. Recently, Zorraquin[3] described a diaphragm cannula. All of these project externally from the tracheal cannula.

Note: Since this article was written, I find that Anton has constructed a somewhat similar valve which also projects externally from the tracheal cannula.

707 Race St.

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1. Bleiweis: Cat. V. Philadelphia, Mueller & Co. P.68, M.6026, Bull. No. 5.
2. Elsberg: Cat. G., Pilling & Son. Co., Philadelphia, 1921-1922, p. 239.
3. Zorraquin, G.: Presse méd. **31**:313 (April) 1923.

PROGRESS IN OTOLARYNGOLOGY

Survey of the Literature of the Last Few Months in the Field of Otolaryngology

INTRADURAL COMPLICATIONS OF AURAL AND NASAL ORIGIN

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RELATIONSHIP OF PHYSIOLOGY TO PROGRESS IN THE TREATMENT OF INTRACRANIAL COMPLICATIONS

Any progress that has been made in the diagnosis and treatment of suppurative diseases of the brain during the last few years has been the result of an application of recognized normal physiologic relationships of the cerebrospinal fluid system with the hemic and respiratory systems.

It has long been known that obstruction to the venous return from the head produces an elevation of the intracranial pressure, but it is only recently that manometric variations (in induced venous congestion of the head by pressure on the jugular veins and carotid artery) have been utilized for the diagnosis of obstructive lateral sinus thrombosis.[1]

From time immemorial it has been known that magnesium sulphate given by mouth has relieved certain types of headache, but Weed and Foley [2] have demonstrated that the bulk of the brain is actually reduced after the administration of hypertonic salt or magnesium sulphate solution by a process of dehydration of the brain.

Further, for years it has been understood that the chlorid percentage content of the cerebrospinal fluid is normally higher than that of the blood; but it is only during the last few months that the continuation in meningitis of this high percentage has been utilized as a favorable prognostic sign (Greenfield).

Moreover, it has long been presumed that a local immunity must exist adjacent to a suppurating area in the ear or nose, to account for the apparent freedom from meningitis which has followed exploratory punctures through the infected mastoid. However, it is only during the last two years that a definite attempt to strengthen the normal immunity

1. Tr. Am. Rhin., Laryng. & Otolog. Soc., Washington, D. C., 1925 (to be published).

2. Foley, F. E. B.: Alterations in the Currents and Absorption of Cerebrospinal Fluid Following Salt Administration, Arch. Surg. **6**:587-604 (March) 1924.

of the cerebrospinal fluid by repeated small transfusions from an immunized donor has been utilized in the treatment of meningitis.[3]

Lumbar puncture, unfortunately, has been followed by sudden death in cases of cerebellar tumor or abscess, but in the last year it has been demonstrated that instead of the Cheyne-Stokes' respiration resulting from herniation of the brain through the foramen magnus, a fatality only occurs with cerebral displacement of the brain stem, in which condition the vessels are stretched by the cerebral tissue being gradually moved from the median line because of the growth of the abscess, but tearing if abnormal strain is further and suddenly increased by a lumbar puncture, which thus causes extravasation of blood in the pons.[4]

INTRACRANIAL COMPLICATIONS OF OTITIS AND SINUSITIS

Frequency.—From the Edinburgh clinic, Fraser[5] reports that 609 simple mastoid operations were performed from 1907 to 1921; of these, one patient had cerebellar abscess and three had abscess of the temporal lobe. During the same period, 1,305 radical or modified radical mastoid operations were also performed, associated with cerebellar abscess in twenty-five cases and abscess of the temporal lobe in twenty-seven cases.

From 1911 to 1920, Yerger[6] studied 116 cases of intracranial complications of suppurative otitis media at Cook County Hospital. Of the total number of cases of suppurative otitis media, 10 per cent. had some form of intracranial complication, as might be expected in a general hospital, admitting only actually ill patients. Meningitis was the most frequent complication. (It occurred in 5 per cent. of all the cases of suppurative otitis media.) The sixty-three cases of meningitis showed a mortality of 97 per cent.

Of the twenty-nine cases that came to necropsy, 100 per cent. showed meningitis; 34 per cent. of the 116 cases had cerebellar abscess, and 10 per cent. extradural abscess.

Sigmoid sinus thrombosis was second in frequency; thirty-four cases being observed (3 per cent. of the cases of suppurative otitis media).

Brain abscess was third in frequency, twenty-three cases being observed (2 per cent. of the cases of suppurative otitis media). Thirty-five per cent. of the sixty-four cases of brain abscess were of otitic origin; of the eighteen patients with otitic brain abscess undergoing operation, only one recovered (a mortality of nearly 95 per cent.).

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3. Eagleton, Wells P.: Surgical Treatment of Meningitis, J. A. M. A. **83**:1900 (Dec. 13) 1924.

4. Eagleton, Wells P.: The Operative Treatment of Cerebellar Abscess of Otitic Origin. Important Mechanical Factors, Surg., Gynec. & Obst. **39**: 653-659 (Nov.) 1924.

5. Fraser, F. R.: Brit. M. J. **2**:993 (Nov. 29) 1924.

6. Yerger, C. F.: Intracranial Complications of Suppurative Otitis Media, Illinois M. J. **46**:260 (Oct.) 1924; ibid., Some Observations on the Diagnosis of Intracranial Complications, Eye, Ear, Nose and Throat Monthly **3**:385, 1924.

Of the cases in which the diagnosis was confirmed either by operation or by necropsy, 65 per cent. were temporosphenoidal, 23 per cent. occipital, and 12 per cent. cerebellar.

Only eight cases (0.6 per cent.) of manifest labyrinthitis with spontaneous labyrinthine symptoms were observed.

PATHS OF INFECTION OF INTRACRANIAL COMPLICATIONS

Myers,[7] in "Tracts Other Than Otitic for Intracranial Infection," states that a potential pathway for infection to enter the cranial cavity is provided by every opening in the skull through which nerves make their exit or blood vessels pass. Infection in the region drained by the frontal, supra-orbital and facial veins—tributaries to the ophthalmic vein which enter the skull through the sphenoid fissure and terminate in the cavernous veins—may often be conveyed by their vessels into the cranium. The cribriform plate of the ethmoid is the point of communication between the nose and the dural spaces, either by the venous or by the lymphatic route, and by the olfactory nerve. (Nine cases of meningitis following submucous resection have been collected by Myers.) Other noteworthy tracts are the foramen magnum, the parietal and the mastoid foramina. An infection in the occipital vein may be carried to the longitudinal sinus, through the parietal foramen to the lateral sinus, through the mastoid foramen to the inferior petrosal and the cavernous sinus through the condyloid and foramen magnum.

Sussig [8] reports the unusual origin of a brain abscess from a periostitis alveolaris, after the production of an osteomyelitis of the squamous portion of the temporal bone. The patient had been troubled with his teeth and suffered from painful swelling of the left cheek at the level of the alveolar process of the upper jaw. Two days later, he was unable to open his mouth. The extraction of the teeth was followed by chills, high fever, sharp pains in the left half of the head, edema of the eyelids and fluctuating swelling, the size of a hen's egg. An incision by the mouth yielded fetid pus, which showed the presence of a mixed infection. Six days later, after a brief stage of excitement the patient passed into deep coma and died. Necropsy showed periostitis of the left superior maxilla, phlegmonous inflammation of the surrounding tissue, circumscribed ostitis and osteomyelitis at the thinnest point of the left temporal bone, circumscribed purulent meningitis and an abscess the size of a hen's egg in the left temporal lobe.

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7. Myers, T. L.: Eye, Ear, Nose and Throat Monthly **3**:566, 1924.

8. Sussig, L.: A Case of Brain Abscess as the Result of Periostitis Alveolaris, Med. Klin. **20**:1648 (Nov. 23) 1924.

Osteomyelitis of aural origin involving the parietal bone, was the cause of a parietal lobe abscess in Piffl and Poetzl's [9] case; the external soft parts being entirely unchanged, and the focus in the dura and the adjacent brain portions being exactly the same size as the osteomyelitic process in the bone. The process extended by way of the diploë, the dura and the brain becoming secondarily involved.

A man, with chronic otitis media, complained of severe, occipital headache, vertigo and vomiting, which pointed to a diagnosis of "temporal lobe abscess" on the left side. Operation showed a large disintegrating cholesteatoma in the mastoid process. No pus was found on exposure nor on incision of the left temporal lobe. On enlarging the posterior portion of the mastoid cavity, a quantity of discolored offensive pus escaped under high pressure, probably from an extradural abscess situated over the parietal lobe. The dura here was tense and discolored, as if necrotic. The surface of the exposed brain showed a purulent exudate between the convolutions. On incision, a brain abscess was voided, which was surrounded by softened and inflamed brain substance. A prolapse larger than an apple formed, but the abscess healed after ablation of necrotic portions.

Hofmann's [10] contribution is based on a careful study of six otitic temporal lobe abscesses from the pathologic collection of Neumann's Clinic in Vienna.

He points out that all six abscesses, in spite of differences, agreed in two respects; namely, the behavior of the abscess as regards the medullary or cortical substance; and the evident tendency of all the abscesses to extend in a mesial direction toward the lower horn. The vascular distribution apparently plays an important part in both respects. Briefly summarizing, the lesson taught by the six cases concerning the distribution, restriction, and configuration—he states that their situation and distribution is regular and essentially dependent on two factors; one of which is constant, namely, the texture of the brain substance (especially the distribution of the vessels), while the other is variable, namely, the mode of entrance of the infection; all of which has been previously emphasized in this country.[11]

INFLUENCE OF TRAUMA DURING A MASTOID OPERATION IN THE PRODUCTION OF BRAIN ABSCESS

Kahn [12] reports a large temporosphenoidal abscess found at necropsy of a woman, who had died about a month after a mastoid operation.

9. Piffl, O., and Poetzl, O.: An Otogenous Parietal Lobe Abscess, Arch. f. Ohrenh., Nasen.- u.- Kehlkopfheilk. **112**:93, 1924.
10. Hofmann, L.: Abscess of the Temporal Lobe, Monatschr. f. Ohrenh. **58**: 1061, 1924.
11. Eagleton, W. P.: Brain Abscess, Its Surgical Pathology and Operation, New York, The Macmillan Company, 1922.
12. Kahn, A.: Laryngoscope **34**:579, 1924.

Definite signs of brain abscess were absent, the patient having died with a diagnosis of possible encephalitis. Kahn's explanation of the absence of later symptoms is that when the brain was exposed by the operation (in reality, a decompression) there was a reaction on the part of nature to enable the abscess to break externally.

UNUSUAL TYPES OF BRAIN ABSCESS

Coates and Case [13] report a case of multiple brain abscess following chronic suppurative otitis media and labyrinthitis with unusual pathologic findings at necropsy. This is a valuable contribution to our knowledge, as some authors contend that apart from metastatic ones, distinct and separate abscesses do not occur; the so-called "second" abscess being simply an extension of the primary one.

Cases of otogenous brain abscess following healed otitis media are commented on by Slenius,[14] who described three patients with inflammation of the middle ear in which healing occurred and the perforation closed, in whom, weeks or months later, a brain abscess developed. He also gives brief reports of seventeen other cases from the literature. In all of these twenty cases, healing of the middle ear disease was apparently complete before the symptoms of brain abscess developed. In eighteen, the disease was acute and in two chronic; in two of the former there had never been a perforation of the drum. The abscess was cerebellar in six and cerebral in fourteen. Fifteen of the twenty patients died and came to necropsy.

CEREBELLAR ABSCESS

Fraser [15] observed eight cases of cerebellar abscess; one from acute and seven from chronic otitis. Four of the eight patients recovered and four died.

Of the seven patients with chronic otitis, only two had labyrinth suppuration, and in both of these there was an extradural abscess deep in the posterior fossa in the region of the saccus endolymphaticus.

He notes that in only two of the seven chronic cases did the patient complain of giddiness or loss of balance.

Under "A Pathological Contribution to the Genesis of Otogenous Cerebellar Abscess," Berkholz [16] reports a case in which the necropsy showed a deep cerebellar abscess, originating from the internal porus acusticus, in a patient who died four days after operation with signs of sudden paralysis of the respiratory center.

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13. Coates, G. M., and Case, E. A.: Ann. Otol., Rhinol. & Laryngol. **33**:335 (June) 1924.
14. Slenius, P.: Acta Laryngol. 5: F. 3.
15. Fraser, J. S.: Cerebellar Abscess, Brit. M. J. **2**:993 (Nov. 29) 1924.
16. Berkholz: Arch. f. Ohrenh. **112**:125, 1924.

During life, the first typical cerebellar symptom was a change in the direction of the nystagmus as first described by Neumann.

However, that the appearance of nystagmus in the course of cerebral suppuration may not be pathognomonic of cerebellar abscess—a fact not sufficiently appreciated—is demonstrated by a case of Alcaley,[17] who reports a case of "Otogenic Temporal Lobe Abscess, with Nystagmus Toward the Affected Side." The radical operation was followed by a single elevation of temperature, which then became normal for about three weeks, and succeeded by a sudden rise, with retardation of pulse; severe headache, nausea, leftsided facial paresis, horizontal nystagmus to the right, no nystagmus on looking to the left. Explorations of the posterior cranial fossa and cerebellum gave negative findings. However, incision of the dura of the temporal lobe evacuated an enormous abscess, containing at least 80 c.c. of fetid pus. Recovery took place in two and a half months.

The unusual complication of cerebellar abscess of otitic origin which had compressed the fourth ventricle, and in which the circulation of the cerebrospinal fluid was so seriously obstructed as to result in hydrocephalus, is reported by Petrillo.[18] The clinical picture showed muscular hypertonia without increased reflexes and without clonus.

DIFFERENTIAL DIAGNOSIS OF BRAIN ABSCESS

That incipient polyencephaltis with suppurative otitis media may suggest a cerebral abscess is commented on by Citelli,[19] from personal observations on two cases of acute nonpurulent encephalitis, with rightsided hemiparesis and leftsided tympanic suppuration. He calls attention to the difficulty of the diagnosis at the onset, as the symptoms often suggest a cerebral abscess of otitic origin.

Lithgow [20] records a left temporal lobe abscess which was admitted as cerebral syphilis, because of a strongly positive Wassermann reaction, although a chronic leftsided suppuration, with homolateral headache, vomiting, confusion and optic aphasia existed. Evacuation was followed by recovery.

PSEUDO BRAIN ABSCESS

One of the most valuable contributions pertaining to lesions frequently mistaken for brain abscess is that of Yerger [21] on "Acute Toxic

17. Alcaley, B.: A Case of Otogenic Temporal Lobe Abscess, with Nystagmus Toward the Affected Side, Monatschr. f. Ohrenh. **58**:107, 1924.

18. Petrillo, L. M.: Arch. Latino-Am. de Pediat. **18**:295, 1924.

19. Citelli, S.: La polyencephalite au debrit avec otite inogenic purulente eput faire penser a un abscess cerebral (I. Italian Oto-Neuro-Ophthalmological Congress, Naples, October, 1924), Rev. de Laryngol., d'Otol. et di Rhinol. **8**: 277, 1925.

20. Lithgow, T. D.: J. Laryngol. & Otol. **39**:650, 1924.

21. Yerger, C. F.: Acute Toxic Meningo-Encephalitis of Otorhinogenic Origin, Arch. Otolaryngol. **1**:190 (Feb.) 1925.

Meningo-Encephalitis of Otorhinogenic Origin," in which he points out that the early recognition of this condition is important, because timely drainage of the focus of infection will result in a cure. He emphasizes the great value of the negative findings of the cerebrospinal fluid in the presence of symptoms of brain abscess.

Four cases are reported. Case 1, a man with acute toxic meningo-encephalitis, due to acute suppurative mastoiditis; the patient recovered after the performance of simple mastoidectomy. Case 2, a boy, had acute frontal sinus empyema, extradural abscess and acute toxic encephalitis, with recovery. Case 3, a boy, had a leftsided cerebellar abscess, with an acute exacerbation of chronic suppurative otitis media, which was responsible for the clinical picture of toxic meningo-encephalitis of otitic origin. Case 4, a boy, aged 8 years, had a meningo-encephalitis of toxic infectious origin from two foci of infection: otitic (from a bilateral suppurative otitis media) and pulmonary (from lobar pneumonia) with the evidence in favor of the former, as a paracentesis caused an immediate and marked amelioration of the symptoms.

Caliceti [22] reports a case of cystic serous leptomeningitis of the cerebellum, in which an acute suppuration of the tympanum in a previously healthy pregnant woman was followed about one and a half months later by mastoiditis. Mastoidotomy two weeks after delivery showed an empyema of the antrum, with diffuse ostitis of the mastoid, but no lesion of the sinuses or dura. Subsequent symptoms pointed to a leftsided cerebellar abscess and when the dura was incised, about 50 c.c. of clear serous fluid escaped under pressure, causing a diagnosis of "an interarachnoid serous purulent collection corresponding to the left cerebellar hemisphere," as evacuation was followed by subsidence of symptoms.

Aboulker,[23] in "Hypertension and Hypotension Following Otitis; Their Relation to Ménière's Syndrome, Vertigo and Glaucoma," states that otitis in any of its forms or complications, may be followed by hypertension, with either an acute, a chronic or an intermittent syndrome. The much more common acute forms lend themselves to confusion with brain abscess, which, in the author's opinion, is much less frequent. The otitic character of the chronic forms is often overlooked, because these cases follow recurrent otitis of a latent type (such as chronic middle ear suppuration without an external discharge). The acute forms of hypertension (false cerebral abscess) and the chronic or remittent forms (false cerebral tumors) will be less frequently overlooked, if a systematic examination of the ears and a manometric puncture are performed.

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22. Caliceti, P.: Cystic Serous Leptomeningitis of the Cerebellum, Arch. Ital. di Otol. **35**:115, 1924.

23. Aboulker: Ann. d. mal. de l'oreille, etc. **43**:429, 1924.

With respect to treatment of hypertensive conditions, he emphasizes that the customary treatment by lumbar puncture and decompression has recently been supplemented by the simple injection of hypertonic solutions, such as 30 per cent. of glucosated serum (Leriche).

ROENTGEN-RAY DIAGNOSIS

Carpenter [24] reports two cases of frontal lobe abscess localized by injection of air into the ventricle, as described by Dandy.

Mayer, in an article on "Destructive Changes at the Base of the Petrous Pyramid in Basal Tumors," describes a most unusual type of intradural suppuration secondary to tumor. His contribution is based on observations in five cases of destruction of the petrous bone in different forms of tumor.

He says destructive changes in basal tumors are found (1) most frequently in the sella turcica; (2) in the pyramids, and (3) in the small wings of the sphenoid. These can clearly be demonstrated roentgenologically, and definite information can thus be obtained as to the nature and starting point of the tumor. Erosion of the pyramids is caused most frequently by tumors of the cerebellopontile angle which are located in the recess between the pons, medulla oblongata and the cerebellum. In the majority of cases, these are new growths—neuromas, fibromas, sarcomas—which originate from the auditory nerve. They often grow plug-shaped into the internal auditory meatus, and under some circumstances lead to local suppuration, which can be demonstrated roentgenologically. The apexes of the pyramids may be destroyed from below by peritubal tumors, which are either sarcomas originating from the connective tissue of the tubes, or carcinomas originating in the fossa of Rosenmüller. Both are characterized by a defect (concave downward) at the tip of the petrous bone. Tumors developing in the apex of the pyramid itself are generally carcinomatous metastases, the apexes of the pyramids being, so far as the temporal bone is concerned, sites of such metastases.

VESTIBULAR REACTION IN INTRACRANIAL, AURAL AND RHINOLOGIC CONDITIONS

Spiegel and Demetriades,[25] in "The Central Mechanism of Vestibular Fall of Blood Pressure and Its Significance in the Causation of Labyrinthine Vertigo," furnish an important contribution to the anatomy and physiology of the vegetative nervous system. The authors conclude that the cells of the nucleus triangularis provide for the conduction

24. Carpenter, E. R.: Pneumoventriculography in the Localization of Brain Abscess, Arch. Otolaryngol. **1**:392 (April) 1925.
25. Spiegel: Arch. f. d. ges Physiol. **205**:328, 1924.

of the stimulus to the bulbar vasomotor center, the connections probably being bilateral.

Ibbolson [26] reports a case of extradural abscess, containing 2 ounces of pus, situated in the cerebellopontile angle, which presented diplopia on looking forward, and exhibited the "optic radiation reflex," namely, a vertigo was produced with nystagmus, when a concentrated beam of light was thrown on the retina of the affected side.

There have been numerous articles on the vestibular tests in the diagnosis of cerebral tumors, two especially full reports being those of Dennis [27] and Wishart.[28] None of them justify the extreme claims of localizing value made for these tests several years ago. In my opinion,[29] the vestibular tests are of value in chronic surgical intracranial lesions such as tumors: (1) in the diagnoses of acoustic nerve tumors; (2) in demonstrating increased intracranial pressure, especially of the posterior fossa; (3) in demonstrating effusion in the pia-arachnoid spaces from blood or exudate. (That is, after injury to the head with blood or effusion from inflammation, especially of the posterior fossa, the 50 per cent. reduction in the duration of the induced nystagmus often makes it feasible to demonstrate the injury long after all other objective signs have disappeared.)

Special importance is attached by Smith [30] to a careful examination of the vestibular apparatus in brain abscess which, he states, is often the only indication of the presence of an intracranial process, not positively of a brain abscess, but of increased intracranial pressure. (The vestibular manifestation, namely, the absence of reactability to the cold caloric test of the side opposite to the lesion, in the upright position—was first described by me [31] in 1912.)

By means of exhaustive examination of the vestibular apparatus, Smith claims to have been enabled to determine the location of an abscess in the cerebellum or in the temporal lobe. Detailed labyrinth reactions should never be omitted prior to the operation.

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26. Ibbolson: J. Laryngol. & Otol. **40** (Jan.) 1925.

27. Dennis, F. L.: A Case of Cerebello Pontile Angle Tumor with Examination of the Vestibular Apparatus—Necropsy, Ann. Otol., Rhinol. & Laryngol. **33**:862 (Sept.) 1924.

28. Wishart, T. M.: J. Laryngol. & Otol. **39**:638 (Nov.) 1924.

29. Eagleton, W. P.: Vestibular Tests in Intracranial Surgery. Third Communication to the American Neurological Society, Washington, D. C., May 5, 1925 (unpublished).

30. Smith, S. MacEuen: A Consideration of Otitic Brain Abscess, with Special Reference to Diagnosis and Localization. Presentation of Specimens and Cases, Laryngoscope **34**:534 (July) 1924.

31. Eagleton, W. P.: Decompression, etc.: with a Previously Undescribed Aural Manipulation of Increased Intracranial Pressure, Tr. Am. Otol. Soc., **12**:564-574, 1912; ibid., Laryngoscope (May) 1923.

Precechtel [32] furnishes a most important communication on "The Influence of Anesthesia of Peripheral Nerves on Peripheral and Central Past-Pointing," which amplifies and extends Bárány's freezing experiments on the cerebellum. By the production of "nerve block" (by local anesthesia) he removes peripheral stimuli to the central portions of the "arcs," which have to do with past-pointing and thus to demonstrate central lesions—before compensation sets in—for a few minutes only. He thus fulfils limitations, which on biologic grounds must be overcome to make the past-pointing tests of any localizing value in chronic lesions of the central nervous system.

One of his cases provides evidence that normally stimuli are conveyed from the skin and mucous membrane of the external canal, as well as from other areas supplied by the cutaneous great occipital nerves, which have to do with falling and past-pointing—that is, with proper orientation.

After recent recovery from cerebrospinal meningitis, the patient was totally deaf and had no reaction to rotation or caloric stimulation. As the result of caloric stimulation of the auditory meatus, however, it was possible to observe distinct past-pointing and falling, the latter dependent on turning of the head (in the presence of a nerve block of the right or left great occipital). The falling could be directed either to the right by irritation with ether over the nervus occipitalis major of the right side, or to the left by inducing stimulation in the same way over the nervous occipitalis major of the left side. At the same time it was also possible to observe that the falling depended on the head being turned while the external caloric stimulation was present.

From these observations it was concluded that, in the case of an insensitive labyrinth, it is possible through the usual caloric stimulation of the external auditory meatus to induce past-pointing, and that the external caloric stimulation can cause falling which, with different positions of the head, is controlled by the cervical reflexes.

He also reports observations on the influence on past-pointing, associated with lesions of the cerebellum, by the removal of the normal stimuli from the nose by nasal anesthesia.

In two cases, an affection of the left cerebellar hemisphere had been diagnosed. In both, the right arm spontaneously pointed inward. After introduction of a cocainized tampon in the right nasal cavity, in both cases the left arm also began to deviate outward, while the right arm continued to point inward. After the left nasal cavity had been anesthetized, the pointing of the right arm inward remained uninterfered with, and a deviation of the left hand inward was observed.

A female, aged 21, suffering from chronic otitis media with cholesteatoma, developed a cerebellar abscess on the left side, which was opened. The deviation of both extremities outward observed before the operation was compensated soon after the operation. A month later, the influence of asymmetrical peripheral anesthesia on pointing was repeatedly tested, and it was found that a deviation of the right arm inward invariably took place, the left arm (the side of the lesion) pointing correctly, after two minutes of anesthesia,

32. Precechtel, A.: J. Laryngol. & Otol. **40**:233 (April) 1925.

whether applied to one conjunctival sac, nasal or buccal cavity on the left or on the right side, and also after anesthesia of the nervus occipitalis minor on the left side.

The author also refers to cases showing the intimate relationship between the frontal and cerebellar regions, a fact long recognized, although the peripheral influence of nasal stimuli on cerebellar lesions is original.

Two cases of serous meningitis in the right lateral cisterna pontis showed that the lesion in the cerebellum need not be considered in order to induce deviation. Before operation, one of the two cases showed deviation of the right arm outward, which was compensated soon after the operation (that is, the spontaneous deviation disappeared).

Three weeks after the operation a cocainized tampon was introduced into the right nasal cavity. After three minutes, the right arm pointed considerably outward, the left one pointing correctly. The original deviation was compensated, in this case in its latent stage, and was again induced through an asymmetrical peripheral anesthesia. In the other case, pointing was correct both before and after the operation. Five minutes after insertion of cocain into the right nasal cavity, the right extremity pointed correctly; the left one, however, pointed outward. After a time, the deviation became compensated and changed into a deviation inward; this again became compensated and changed into a deviation outward.

Precechtel thinks it is necessary to conclude from these experiments that the nucleus of Deiters, or other vestibular nuclei, also cooperate during compensation and that a deviation sets in if the function of this nucleus is temporarily suspensed by peripheral blocking.

His summary is:

1. Peripheral stimulation (experimental and pathologic) of the sensory nerves on the head (trigeminal, vestibular or nerves of the cervical region) can induce past-pointing.

2. The peripheral stimulation exists also in the case of past-pointing, due to caloric stimulation of the auditory meatus (trigeminus).

3. Peripheral deviations (experimental and pathologic), originating in either half of the head, can be suppressed by unilateral anesthesia in the region of any sensory nerve of the head or neck (trigeminus, vagus or cervical nerves).

4. The suppression is but a temporary one, even if anesthesia is continued. It can be explained by diaschisis ("transitory phenomena after a restricted lesion of the brain") in the region of the nucleus Deitersi or other vestibular nuclei.

5. Correct pointing during diaschisis is contingent on correct function of cerebellorubrospinal tract.

6. Diaschisis due to peripheral anesthesia cannot suppress deviations of central origin.

7. Latent or compensated central deviations can be made manifest by a diaschisis in the region of the nucleus Deitersi.

RESULTS

That much is still to be desired in our diagnosis and surgical handling of brain abscess is shown by the report from Neumann's clinic, in which, of eighty-two temporal lobe abscesses operated on since 1907, only twenty were cured; of twenty-eight operated on since 1918, seven recovered.

In three cases counter incision was unquestionably successful. In one case the pons was divided between the incision and counter incision, as prolapse impeded drainage.

Three brain abscesses of otitic origin, cured by operation, are reported by Hautant, Ramadier and Lanos,[33] who believe that the lesson taught by these cases is the imperative necessity for free incision of the abscess, without delay, with frequent change of dressings and repeated inspection of the abscess cavity, as the danger of retention of pus is very serious under exclusive employment of drainage. The first case concerned an enormous abscess of the temporal region, but all signs of localization were absent. No apparent pathologic macroscopic lesion between the ear and the encephalitic complication was demonstrable, although the infection had undoubtedly entered along the roof of the antrum or attic. In the second case, a much smaller abscess was found in the same region, and this was associated with the syndrome of cerebral hypertension (headache, vomiting, insomnia, incoordination of pulse and temperature and choked disk). On the day following the operation, a paresis of the extremities of the opposite side appeared. The third case was a cerebellar abscess of moderate size.

Sherry,[34] in "Suspended Respiration in a Case of Brain Abscess," comments that while the patient was being prepared for operation, a decompression operation was done after four hours' artificial respiration. The dura bulged, and, when incised, the brain also bulged. A cannula disclosed pus at a depth of 3 cm. Necropsy disclosed chronic osteomyelitis of the temporal and parietal bones; a sinus through the mastoid extending from the skin to the dura; greenish serous exudate in the middle ear and mastoid which contained gram-positive and gram-negative organisms; chronic leptomeningitis of the occipital region, organized thrombi obliterating the sigmoid, transverse and superior petrosal sinuses, and numerous abscesses in the posterior pole of the temporal lobe, the largest 1.5 cm. in diameter.

Under "Surgery and Postoperative Treatment of Temporal Lobe Abscess," Beck [35] relates how, after necropsy, sections through the brain

33. Hautant, Ramadier and Lanos: Three Brain Abscesses of Otitic Origin, Cured by Operation, Ann. d. mal. d. l'oreille, Paris **43**:1474, 1924.

34. Sherry: Ann. Otol., Rhinol. & Laryngol. **33**:1401, 1924.

35. Beck, O.: Operation des Schlafelappen abscesses, Ztschr. f. Hals.- Nasen.- u. Ohrenh. **10**:219, 1924.

(hardened in formaldehyd) showed that the abscess had been opened and drained, not in the middle of its extent but in its lateral portion. At the time of radical operation, a labyrinth fistula of the horizontal semicircular canal, as well as an extradural abscess, were found. Nineteen days later, the patient suddenly had vertigo, vomiting and typical sensory aphasia. A temporal lobe abscess was opened, with the application of a counterincision.

SURGICAL TREATMENT OF BRAIN ABSCESS

The literature of the last few months, though voluminous, contains little that is original with regard to the treatment of brain abscess, the chief exception being King's [36] contributions. He, apparently subconsciously, has utilized his war experience in traumatic abscesses—which have long been known to give better results to surgical treatment than adjacent otitic and nasal accessory sinus abscesses—and has applied the lessons of wide dural openings and extensive cortical destruction to the latter. He, thus in reality, converts an adjacent otitic abscess into a traumatic one by his surgical attack. His successful results would apparently demonstrate that, providing the patient recovers from the much greater shock (which must necessarily accompany so radical a damage of central tissue), the chances of ultimate recovery are much increased, as the abscess having in reality been completely placed outside of the dura by the "uncapping" and subsequent cerebral herniation, secondary encephalitis or meningitis is less liable to occur.

King came to the following conclusions:

> 1. Various operative procedures, heretofore described, in which numerous kinds of drainage materials were used, have usually been followed by a high mortality rate. 2. In all of these procedures described, prevention of hernia cerebri has been desired. 3. The operative technic and postoperative treatment embrace the following: Creation of a rather larger cranial defect directly over the abscess cavity; complete "unroofing" of the cavity; complete herniation or eversion of the cavity; irrigation with surgical solution of chlorinated soda of the area under treatment; prevention of trauma and early compression of hernia cerebri; and later, epithelization.

Four of his patients consecutively operated on in this manner have recovered. The procedure he described is applicable to all cases of brain abscess in which the "roof" of the abscess can be removed, and the abscess cavity can herniate through the cranial defect.

POSTOPERATIVE TREATMENT

He describes his method of combating infection by the use of surgical solution of chlorinated soda, and advises the prevention of overdistention

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36. King, J. E. J.: The Treatment of Brain Abscess. A Surgical Technic in Which the Usual Drainage Methods Are Avoided, Arch. Otolaryngol. **1**:26, (Jan.) 1925; ibid., Surg., Gynec. & Obst. **39**:554 (Nov.) 1924.

of the ventricular system by means of lumbar puncture, when indicated. The wound is strapped with adhesive strips after slight necrosis on the surface of the hernia has ceased, and after the surface of the hernia has become covered with healthy granulations followed by recession of the hernia with epithelization. The average time which will be required from the time of the operation until the hernia has completely receded and the granulating surface has become covered with epithelium, is about from two to three months. The author also describes an apparatus used for irrigating the wound and protecting the brain hernia.

Yerger [37] reports two cases of left temporal lobe abscess, in which the diagnosis and the decision to interpose surgically were based practically on the presence of optical aphasia, or inability to name objects.

As these abscesses are always of otitic origin, he thinks the ideal operation is through the avenue of infection, the mastoid and the tympanic cavity, because: (1) it is less dangerous; (2) in the majority of cases nature has already "cofferdammed" this approach to the abscess by sealing off the subarachnoid space; (3) this route gives evidences of the location of the abscess (the reddish area of meningitis, granulations on the dura, the fistulous connection with diseased bone, and localized bulging of dura with lack of pulsation); (4) the site of the brain abscess is most often found near the diseased bone; (5) it gives the best drainage on account of gravity, and (6) because the causative infection should also be cleaned up.

Yerger holds that the visual fields should be tested in all suspected cases; that delayed cerebration is characteristic of the condition, and that a slow pulse is an important diagnostic sign. Optic neuritis or choked disk is much more common in cerebellar abscess than in temporal lobe abscess.

Elsberg [38] states that the acute abscesses in the temporal lobe which so often complicate middle ear disease, usually have a lining membrane. The acute cerebellar abscess, on the other hand, rarely has a definite abscess wall. The abscess of long standing, however, whether in a temporal or in a cerebellar lobe, usually has a limiting membrane. In the brain abscess which occurs as a complication of frontal or of ethmoid sinus disease, a distinct wall is often present, while in the acute intracranial suppuration that follows infection within the orbit, the abscess, generally in the homolateral frontal lobe, is usually without any lining membrane.

In known or doubtful cases of abscess with no limiting wall, Elsberg recently has performed a radically changed operation. As soon as the

37. Yerger, C. F.: Left Temporal Lobe Abscess with a Report of Two Cases, Ann. Otol., Rhinol. & Laryngol. **33**:1364 (Dec.) 1924.

38. Elsberg, C. A.: The Technic of Operations for Abscess of the Brain, Arch. Otolaryngol. **1**:14 (Jan.) 1925.

pus has been found with the exploring needle, and while the needle is still in place, the opening in the bony skull is enlarged until a large aperture in the skull (about 5 by 6 cm.) has been made. The dura is widely opened, and iodin gauze packings are inserted all around. An incision, from 3 to 5 cm. in length, is then made in the cortex, and is carefully deepened until the abscess cavity has been exposed and opened. Instead of using a tube for drainage, a piece of rubber dam with gauze strips packed into it is inserted into the abscess cavity, thus forming a Mikulicz tampon, which keeps the abscess cavity wide open. With this radical change in the treatment of abscesses without a lining membrane, the author has seen patients recover, in whom, hitherto, a progressive involvement of brain tissue and a fatal outcome would have been predicted.

AFTER TREATMENT OF BRAIN ABSCESS

Koerner [39] records his methods of after treatment of otogenous brain abscess during the last three and a half years, during which time six patients with brain abscess were admitted to his clinic; four of the abscesses were cerebral and two, cerebellar. One patient with cerebral abscess died three hours after the operation, due to extensive encephalitis and meningitis. The other five patients were cured. In the after treatment, Koerner considers it important to leave the abscess cavity alone, as far as possible, after a thorough removal of pus and necrotic brain débris, with disinfection.

Koerner advises the removal of necrotic brain shreds with suitable forceps, but other instrumental intervention in the cavity should be omitted. Palpation of the walls with the fingers is both unreliable and nonpermissible, as it is impossible to tell whether the finger is in a recess of the abscess or is in softened but still viable brain substance. Moreover, a thin brain layer between the abscess cavity and the lateral ventricle may be ruptured. Scraping of the necrotic débris with a sharp curet is not recommended, nor is the removal of an abscess membrane. Cautious irrigation of the cavity is indispensable, and Koerner adds hydrogen peroxid to the irrigating fluid, and thus obtains not only the mechanical cleansing of the cavity from persistent necrotic shreds—which are detached and raised by the oxygen bubbles—but, also, he thinks, gives a rather efficient disinfection. Filling the cavity with gauze, or so-called "gauze drainage," is rejected, but the cleansed cavity should be dusted with boric acid and iodoform and left empty. The new-formed pus must be provided with a permeable and harmless exit, by means of rigid, stiff tubes, usually curved, because cerebral abscesses are usually opened from below through the emptied mastoid process; and cerebellar abscesses, especially those of labyrinthine origin, from in front.

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39. Koerner, O. M.: Deutsch. med. Wchnschr. **51**:95 (Jan. 16) 1925.

IMPROVEMENTS IN SURGICAL TECHNIC

Muck,[40] in his paper entitled, "The Sitting Position, a Necessary Change of Position in Certain Operations on the Brain," enlarges on his observations of 1920.

He states that in operating on abscess cavities, it is often useful to change the ordinary horizontal position of the patient to a sitting position, which will enable the surgeon to obtain a good view of the cavity after it has been emptied. He calls attention to the fact that traumatic holes in the skull (covered with skin), when they are not too small, sink in when the paient sits up and the head is turned toward the normal side; on the other hand, on turning the head toward the diseased side the scalp lifts over the hole. Further, in mastoid operation the sinus wall can be seen pulsating actively when the patient is in a sitting position and the head is turned to one side; thus because the venous plethora, which exists in the horizontal position, diminishes. He has also observed during cranial auscultation (in young persons in a sitting position, with the head turned toward the nonauscultated side), that there is a pronounced venous murmur, as in this position the venous blood flows off more quickly. This is due, he thinks, to congestion on one side and a decrease of the skull contents of the other side (brain volume and venous blood). Therefore, pathologic hollow spaces, abscess cavities and cysts can be inspected better with the patient in the sitting position because, in this position, their walls can be partially collapsed or distended as desired.

Volkmann[41] recommends an encephaloscope for the direct inspection of the brain. The construction resembles the ordinary cystoscope, as first developed by F. Whiting in this country over twenty years ago.

Hemostasis in brain operations is discussed by Heymann.[42]. He believes that the most reliable method for the avoidance of troublesome hemorrhage from the brain tissue consists in the removal of the so-called general brain pressure. This can almost invariably be accomplished by the application of a sufficiently large gap in the bone and dura, by extensive puncture of the ventricles and cisterns, or by puncture drainage of the edema in the subarachnoid space.

Eagleton[43] enlarges on his previous communication regarding the necessity for obliteration of the descending portion of the lateral sinus in the exploration and the drainage of cerebellar abscess by invulsion of the outer wall into the lumen of the sinus.

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40. Muck, O.: Arch. f. klin. Chir. **128**:450, 1924.
41. Volkmann, T.: The Encephaloscope, Zentralbl. f. Chir., 1924, No. 23, p. 1233.
42. Heymann, E.: Hemostasis in Brain Operations, Zentralbl. f. Chir. **40**: 1497 (Oct. 6) 1923.
43. Eagleton, W. P.: The Operative Treatment of Cerebellar Abscess of Otitic Origin, Important Mechanical Factors, Surg., Gynec. & Obst. **39**:653 (Nov.) 1924.

NASAL DISEASE AS CAUSE OF CRANIAL SYMPTOMS

Bohan [44] reports two cases of hemiplegia, with spontaneous recovery, probably due to infection in the nasal accessory sinuses, and assumes an external pachymeningitis in both cases, while admitting that this interpretation is based only on probability. The first patient, a woman, aged 24, with an inflammation of both maxillary and frontal sinuses, had acute hemiplegia with convulsions. Recovery was spontaneous. This patient also suffered from asthma and urticaria, which were favorably modified by drainage of the sinus and removal of polyps. The second case was one of catarrhal frontal sinusitis; the patient also recovered spontaneously.

Bronzini [45] reports a case of congestion of the nasal mucosa, with obstruction of the endonasal lymphatic passages. The distressing headache of four years' duration, with unilateral manifestations in the optic, hypoglossal, and facial domain, in part resembling the signs of chronic serous meningitis, subsided at once after the removal of adenoid tissue masses.

DIAGNOSTIC DIFFICULTIES OF FRONTAL LOBE LESIONS

Guettich,[46] in "Diagnostic Difficulties in Diseases of the Brain," reports the case of a patient who was admitted showing typical signs of meningitis. There was pus in the left middle meatus, with tenderness on pressure on the floor of the left frontal sinus. A radical frontal sinus suppuration, followed by removal of ethmoid cells and opening of the left sphenoid sinus, revealed no changes in the dura. Rapid recovery followed, and the patient was discharged on the eleventh day, with persistent loss of word memory. Recurrent symptoms of meningitis one month later were referred to the formation of a frontal lobe abscess, but none was found on operation. The necropsy revealed a glioma in the left temporal lobe, which Guettich thinks induced the fatal suppurative meningitis. The first attack he would explain as an influenzal meningitis and sinusitis, independent of each other, while the same infection later caused suppuration and disintegration of the benign gliomatous brain tumor, followed by death.

Charousek and Kubic [47] report a case in which rhinologic examination revealed chronic empyema of the right frontal sinus, and on

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44. Bohan, P. T.: Two Cases of Hemiplegia, with Recovery, Probably Due to Infection in the Nasal Accessory Sinuses, M. Clin. N. Am. **7**:1075 (Jan.) 1924.

45. Bronzini: Intracranial Hyperpressure in Rhinopharyngeal Affections, Zentralbl. f. Hals.- Nasen.- u. Ohrenh. **7**:127, 1925.

46. Guettich: Ztschr. f. Laryngol. u. Rhinol., 1924.

47. Charousek, G., and Kubic, A.: The Functional Relations Between the Frontal Lobes and the Cerebellum, Beitr. z. anat. Phys. Path., in Therap. d. Ohren. **21**:118, 1924.

operation, a bone fistula was found in the inner superior portion of the frontal recess. The fistula was surrounded by granulations and led into a brain abscess larger than a cherry. The dura mater showed chronic inflammatory thickening and was closely adherent to the bone on one side, and to the surface of the brain on the other. The destruction involved chiefly the second right frontal convolution. The patient recovered completely; hence the functional phenomena of apparent involvement of the cerebellar apparatus could not be explained by a lesion of the semicircular system, the cerebellum or the pyramid.

ADJACENT FRONTAL LOBE ABSCESS

On account of the difficulties in the early recognition of frontal lobe abscess, and our imperfect methods of treatment this is still associated with a mortality of over 80 per cent. Too often an apparent recovery has later ended fatally.

Boss [48] thinks that the tendency to recurrence of brain abscess is due to their anatomic shape and surroundings, as it is very difficult to bring all the pockets and recesses of the abscess cavity into view so that none may be overlooked.

He reported two cases, both of which presented difficulties in the diagnosis. The posterior frontal sinus wall at the time of operation was found to be macroscopically intact, and, on exposure of the dura, this was normal in the first case, and presented only insignificant purplish discoloration in the second case. The diagnosis was only verified when changes of the ocular fundus and disturbances of the reflexes occurred in the first case, and from changes of the cerebrospinal fluid in the second case. The first case was characterized by extremely frequent recurrences and a long duration (over one year). An abscess formed six times in the left frontal brain with symptoms of brain pressure. This case also taught that neurologic phenomenon for localization is generally not available in frontal brain abscess. The patient died two days after the operation, and the necropsy showed convexity meningitis. The second patient, who came under observation five days after an automobile accident, made a good recovery after a radical Killian operation and a subsequent removal of the cerebral frontal sinus wall, with evacuation of pus.

Salinger [49] reports an abscess of the frontal lobe following an acute frontal sinus infection with apparent recovery in a patient with a

48. Boss, L.: Diagnosis and Treatment of Rhinogenic Frontal Brain Abscess. Report of Two Cases, Folia Otolaryngol. **13**:120, 1925.

49. Salinger, S.: Abscess of the Frontal Lobe Following an Acute Frontal Sinus Infection; Recovery, Ann. Otol., Rhinol. & Laryngol. **33**:574, 1924; ibid., **34**:210, 1925.

purulent basal discharge, headache, swelling of the eyelids, ocular manifestations and roentgenologic darkening of the leftsided accessory sinuses. As the symptoms persisted after opening the ethmoid and partial removal of the lamina papyracea, the frontal sinuses were operated on four weeks later and were drained by way of the nose. However, the headache continued. At the end of another month, the patient became unconscious with meningeal symptoms. Reopening of the left frontal sinus showed necrosis of the posterior wall, and on its removal the dura was seen to bulge, behind which an abscess was found, containing about 100 c.c. of fetid greenish pus. During the operation, sudden collapse was controlled by epinephrin injection into the heart. An apparent cure resulted. Another operation was again required some weeks later. The patient survived for two days. The necropsy revealed a secondary abscess of the posterior portion of the left frontal lobe with local acute hemorrhagic encephalitis.

Swindells and Rankin [50] report an abscess of the frontal lobe with operation and recovery in a patient with headache and pain in the left lower jaw of six days' standing. Transillumination showed dulness in the left antrum and the left frontal sinus. The antrum was drained, the frontal sinus was opened and found to contain pus. Ten days later, symptoms of brain involvement appeared. The skull was trephined above and to the left of the frontal sinus, and pus was found at a depth of three-fourths inches beyond the cortex; 5 ounces was evacuated. The patient eventually made a good recovery, although twelve days after the operation he had two epileptiform seizures.

Reynolds and Fraser [51] report a case of chronic frontal sinus suppuration. A radical operation was performed, which was followed by purulent meningitis and death.

A woman, aged 80, on whom a radical operation was performed for chronic empyema of the left frontal sinus, showed erosion of the posterior wall of the sinus in three places, the periosteum missing and softening of the underlying bone. After a wide communication had been established with the nose, the operation cavity was packed with iodoform gauze. Six days after the operation, the patient died with symptoms of meningitis. The necropsy showed, besides purulent meningitis, a reddish focus of softening in the anterior portion of the frontal lobe. As no venous thrombosis could be demonstrated, the authors assume a lymphogenic origin of the abscess.

Wishart [52] reports two cases of abscess of the frontal lobe.

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50. Swindells, S. W., and Rankin, A. H.: Brit. M. J. **2**:622 (Oct.) 1924.
51. Reynolds, F. E., and Fraser, J. S.: J. Laryngol. & Otol. **39**:655 (Nov.) 1924.
52. Wishart, J. M.: Four Cases of Abscess of the Brain, J. Laryngol. & Otol. **39**:638 (Nov.) 1924.

In the first patient, following an operation for frontal sinus and ethmoid sinus suppuration which had ruptured to the outside some time previously, a fistula was accidentally discovered in the exposed dura. This fistula was opened and led into a brain abscess. Subsequent inquiry revealed that one and a half months ago, there had been an attack of vomiting, twitching, spasms and loss of consciousness for twelve hours, but this had subsided again. A later incision was followed by permanent recovery.

In the second patient, the abscess was caused by a fall on the head one year previously, which was followed by unilateral deafness and aural tinnitus. The frontal lobe abscess was first discovered at necropsy, which showed the rupture of the abscess into the longitudinal sulcus.

Wishart also reports the case of one temporosphenoidal lobe abscess with recovery; a cerebellar abscess with extradural abscess, with death four weeks after the operation and one day after secondary intervention (with negative exploration) of the temporosphenoidal lobe.

MENINGITIS

This condition still continues to be associated with a mortality of nearly 100 per cent., but distinct progress can be recorded because early diagnosis has engendered a boldness in the operative attack on the basal cisterna in which the disease frequently lies semidormant for some time.[53] At the present time, I believe in the radical removal of the whole area adjacent to the infection, not only to remove the primary focus but also to give a very wide exposure. When a basal cisterna has been reached and evacuated, I advocate the replacement of the evacuated fluid by a modified Ringer's solution, at the body temperature; the placing of the parts at rest by ligation of the internal or common carotid artery of the same side (with ligation of the jugular if there is any suspicion of a venous origin) and the subsequent performance of repeated lumbar punctures, associated with repeated small transfusions of blood from an immunized donor, believing that the cerebrospinal fluid system is thus better enabled to combat the infection by an acquired immunity.

Van der Wildemberg,[54] in recording recoveries in a few cases of meningitis of otitic origin, thinks that the most important measures are accurate observation of the patient, repeated spinal punctures and removal of the inflammatory focus.

The earlier the beginning of meningitis is recognized, and the earlier the inflammatory focus is removed, the better are the prospects for a

53. Eagleton, Wells P.: Surgical Treatment of Meningitis. Third Communication, J. A. M. A. **83**:1900 (Dec. 13) 1924.

54. Van der Wildemberg: Recovery of a Few Cases of Meningitis of Otitic Origin, Bull. d'otorhino-laryngol. et de Broncho-oesophagos. **22**:197, 1924.

cure. The more or less violent course of the disease is governed by the virulence of the bacteria. Cases of otogenic meningitis accompanied by sinus inflammation have the most favorable prognosis. In the presence of purulent labyrinthitis, the opening of the labyrinth may lead to an immediate cure. On the other hand, the operation may also occasion generalized meningitis. It must be kept in mind that purulent labyrinthitis may exist without mastoiditis. This phenomenon was observed by the author in two of the four cured cases of otogenic meningitis. The onset of meningitis manifests itself in polycytosis of the spinal fluid.

In the first case, a child, suffering from acute otitis with meningitis, was saved through opening the subarachnoid space. In the second case, it was necessary to drain according to the method of Jenkins by the oval window and thus to the internal meatus. In the third patient, the exposure of apparently healthy meninges and sinus proved sufficient, together with evacuation of a cholesteatoma. In the fourth case—chronic otitis with symptoms of acute meningitis and labyrinthitis—the operation showed an offensive cholesteatoma. The horizontal semicircular canal presented a fistula and caries, but the operation was discontinued on the assumption that the granulations on the horizontal semicircular canal would form a protection against the advance of the infection. The recovery of the patient justified the conservatism.

On the other hand, the fulminating type of meningitis offers no prospect of successful treatment. Hofman,[55] who reports a case which appeared on the second day after the onset of the otitis and led to death in the course of two days, thinks that the meningitis was not caused by the otitis, but ran a parallel course with the ear disease; as the pathogenic agent, *Diplococcus lanceolatus* was established, the affinity of which for the meninges is well known. He suggests that a plug of cerumen might have prevented rupture of the drum, thus inducing an extension into the endocranium, as at the instant of removal of the cerumen plug, the hitherto depressed tympanic membrane bulged, creating the impression of retention of pus in the middle ear.

AIDS TO DIAGNOSIS OF MENINGITIS

The permeability of meninges to uranin, as a method in the diagnosis of meningitis by Jervell,[56] proposes an interesting method, whereby it is possible to decide simply by lumbar puncture whether meningitis is

55. Hofman, L.: Fulminating Purulent Meningitis, Zentralbl. f. Hals.- Nasen.- u. Ohrenh. **5**:426, 1924.

56. Jervell, Otto: The Permeability of Meninges to Uranin, as a Method in the Diagnosis of Meningitis (Preliminary Communicaton), Brit. M. J. **1**: 210 (Jan. 31) 1925.

present or not. Uranin in doses of 0.03 gm. per kilogram of body weight does not enter the cerebrospinal fluid, or does so only in small quantities if the meninges are not infected. He states that in meningitis the coloring matter enters the fluid in easily demonstrable quantities. If, therefore, by lumbar puncture three hours after administration of uranin (2 gm.) by mouth or by intramuscular injection (20 per cent. solution), the spinal fluid shows distinct greenish fluorescence, the presence of meningitis can be assumed with great probability, without making other investigations of the spinal fluid. If the spinal fluid shows no fluorescence, meningitis can be excluded. The passing of the coloring matter into the spinal fluid merely indicates the greater or lesser permeability of the meninges.

Greenfield,[57] in a most important communication, states that the prognosis previously has rested too much on the presence of bacteria in the cerebrospinal fluid. The pneumococcus always kills when it reaches the subarachnoid space, and the same may be said for the more virulent forms of streptococcus, although it is not always easy to say which types of streptococcus are highly virulent and which are less so. Therefore, if either of these organisms can be grown on culture mediums, the prognosis must be bad. But he states there is a large group of cases which give, on lumbar puncture, a purulent fluid that either shows no organisms or grows a few colonies of some less virulent bacterial type. Fluids of this kind always contain excess of protein and usually no sugar, but in his experience neither of these constituents is of any value at all for prognosis. The only tests which gives us any indication in such cases as to whether or not the meningitis is generalized is the chlorid percentage, and this is of real value.

The chlorids, he thinks, always fall when meningitis becomes generalized, and therefore so long as they remain high there is ground for belief that the area of inflammation in the meningitis is localized.

His interpretation is that:

> From what we know of the cerebrospinal fluid, a fall in the chlorids is due to a breaking down of the barrier which separates blood and cerebrospinal fluid; or, as Mestrezat termed it, "an increase of meningeal permeability": for in health, the chlorids in the cerebrospinal fluid are always higher than in the blood, but when the barrier between the two fluids is reduced, their chlorid percentage tends to approximate to one another.

Greenfield's view is based primarily on Mestrezat's work, and secondarily on a series of seventeen cases of head wounds which he followed after the war. In these patients, lumbar puncture was performed for a variety of reasons, chiefly because of headache. Some had papilledema

57. Greenfield, J. G.: Discussion on Nontuberculous Meningitis, Proc. Royal Soc. Med. **18**:10 (Feb.) 1925.

or bulging craniotomy openings. Of nine patients who recovered, the cerebrospinal fluid was perfectly normal in six. Of the other eight, seven died from meningitis, and in all of these seven cases the chlorids fell to below 680 mg. before death. In one patient who recovered, there were pus and gram-negative diplococci in the spinal fluid, but the chlorids remained at the normal level of from 725 to 750 mg. This series impressed Greenfield so much that since then he has kept watch on the chlorids in every case of suspected meningitis, and he has never known a patient die from meningitis with chlorids at their normal level. (This applies chiefly to the lumbar fluid and may not be so absolutely true for the cisternal fluid.)

Paralysis of the fourth cranial nerve with otitic meningitis is reported by Fiuzi,[58] who emphasizes the rarity of isolated paralysis of the fourth nerve, which, in combination with the pain and changes of fundus, represented in (his case) the first stage of meningitis. He thinks that this type of paralysis had a more serious prognosis than the other isolated paralyses of the cranial nerves. Forty days after an acute right sided purulent otitis, severe hemicrania supervened, with diplopia, from paralysis of the fourth nerve, associated with mild venous stasis of the right fundus. Intervention revealed a large extradural abscess; the sinus did not pulsate. The headache and diplopia promptly disappeared, but a tenderness at the nape of the neck on movements of the head persisted. Eight days later severe headache recurred with vomiting and fever. The patient died from meningitis.

VUZIN AND HEXAMETHYLENAMIN

Nuehsmann [59] treated five cases of otogenous and rhinogenous meningitis by vuzin intraspinally. In sixteen of these cases, the diagnosis was evident, clinically as well as by the cerebrospinal fluid findings. In fourteen of these patients, the primary focus was removed surgically; and injections of vuzin were instituted either before or directly afterward. There were only two survivors among these fourteen patients, and apparently no favorable action was exerted by the vuzin. Nuehsmann consequently thinks that vuzin treatment intraspinally must be rejected, at least in the form hitherto utilized, and that daily spinal punctures through which the most thorough emptying of the cerebrospinal spaces should be done, combined with radical removal of the primary infectious focus, still remain the most efficient therapeutic procedure.

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58. Fiuzi: Arch. internat. de laryngol. **5**:65, 1925.

59. Nuehsmann: Treatment of Otogenous Meningitis with Vuzin, Ztschr. f. Hals.- Nasen.- u. Ohrenh. **10**:244, 1924.

The intraspinal injections of "vuzin hydrochlorate" (Link) possess no therapeutic value whatsoever according to Tommasi,[60] who reports six cases of otitic meningitis, and concludes that a violent and complete meningeal symptomatology may occur in cases of serous meningitis or in meningo-encephalitis, not only in children and in young persons, but also in patients at a more advanced age (50 years).

Canestro [61] discusses the case of two patients with purulent meningitis, one septic, the other aseptic, who were cured by means of injections of hexamethylenamin.

SEROUS MENINGITIS

Whether this is always the first stage of purulent meningitis, or is a separate entity will, in my opinion, depend largely on the pathologic condition present by which the dura is invaded. Jenkins' [62] observation, that the fluid obtained from the subarachnoid spaces of the brain may contain bacteria while that from the lumbar region remains sterile, has been confirmed.

Urbantschitsch [63] performed the radical middle ear operation in the early stages of a general mucosis meningitis, following which the cerebrospinal fluid became nearly clear and sterile. Rigidity at the nape of the neck persisted, however, and the child died. The necropsy showed extensive basal meningitis. The postoperative retrogression of the spinal changes with persistence of the intracranial lesion is commented on.

It is certain that the majority of reported recoveries of meningitis are open to the suspicion of having been of the serous noninfective type.

Popper [64] reports the case of a patient with chronic suppuration with cholesteatoma, labyrinthitis, sinus thrombosis and meningitis, treated with roentgen rays, who recovered. The patient had a radical middle ear and labyrinth operation, because of sudden aggravation of symptoms. An extradural abscess of the posterior fossa, with perisinuous abscess, was discovered. After the operation, the patient complained of severe headache with daily rise of temperature without meningitic symptoms. In view of the operative findings (perisinuous abscess with cholesteatoma), the sinus was first punctured and was found to contain blood. Streptococcus cultures were grown from the sinus blood. The

60. Tommasi: Meningitis and Acute Purulent Otitis Media, Arch. Internat. de Laryngol., 1925, p. 65.

61. Canestro: Therapy of Purulent Meningitis of Otitic Origin, Rev. de laryngol. Paris **8**:277, 1925.

62. Jenkins: Otitic Meningitis. Tenth International Otological Congress, Paris, 1922.

63. Urbantschitsch, E.: Mucous Mastoiditis and Meningitis in a Child of Thirteen Months, Zentralbl. f. Hals.- Nasen.- u. Ohrenh. **5**:426, 1924.

64. Popper, T.: Chronic Suppuration with Cholesteatoma, Labyrinthitis, Sinus Thrombosis Meningitis, Treated with Roentgen Rays, Monatschr. f. Ohrenh. **58**:757, 1924.

sinus was incised, but no thrombus was found. Jugular ligature was subsequently performed as the headache persisted, although the spinal puncture fluid remained sterile. The patient was subjected to roentgen irradiations of the skull, which was followed by improvement of the general condition.

McDougall's [65] case of external meningitis simulating purulent leptomeningitis, secondary to an otitic infection with recovery, in which the diagnosis of external pachymeningitis was found on repeated cultures of the spinal fluid, failed to show a positive culture, although the patient exhibited typical symptoms of purulent leptomeningitis.

Simple mastoidectomy showed all the mastoid cells broken down, filled with pus and granulations throughout. An extradural abscess was revealed in the middle fossa. The necrotic bone around the abscess was removed until the healthy dura appeared. Facial paralysis developed eleven days later. A spinal puncture showed cloudy fluid under considerable pressure. From 20 to 25 c.c. of spinal fluid was removed daily by cisterna magna or lumbar puncture, until the fluid was clear. After an intercurrent attack of smallpox, the patient left the hospital on the forty-ninth day after the operation, completely recovered.

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65. McDougall, W. L.: J. M. A. Georgia **14**:56, 1925.

News and Comment

Local Society Meetings

PHILADELPHIA: Section on Otology and Laryngology of the College of Physicians of Philadelphia meets on the third Wednesday of each month from October to June, at 8:30 p. m., at the College of Physicians. Chairman, Dr. Fielding O. Lewis; Secretary, Dr. James A. Babbitt, 2117 Chestnut Street.

CLEVELAND: Ophthalmological and Otolaryngological Section of Cleveland Academy of Medicine meets on the fourth Friday of each month at the Winton Hotel. Chairman, Dr. E. W. Garrett; Secretary, Dr. M. Paul Motto, Rose Building.

CHICAGO: Chicago Laryngological and Otological Society meets on the first Monday of the month from October to May at the Crystal Room, Great Northern Hotel. Chairman, Dr. E. H. Norcross; Secretary, Dr. A. A. Hayden, 25 East Washington Street.

MILWAUKEE: Milwaukee Oto-Ophthalmic Society meets on the third Tuesday of the month, at the University Club, at 6:30 p. m. President, Dr. John E. Guy; Sec.-Treas., Dr. John J. Brooks, Majestic Building.

Abstracts from Current Literature

Ear

VESTIBULAR ACCOMMODATION AND A DESCRIPTION OF THE QUANTITATIVE CALORIC REACTION OF BRÜNINGS AND KOBRAK. DOUGLAS MACFARLAND, Ann. Otol., Rhinol. & Laryngol. **34**:160, 1925.

Up to the present time, it has been quite universal among otologists to use Bárány's method of mass stimulation both for the caloric and the turning tests. However, the author states that a change is now taking place and the use of minimal stimuli are advocated in order to determine the threshold of nystagmus. Gradenigo of Italy has been using a single turning for the turning test, and the caloric threshold reaction test has been fostered by many noted otologists. The test bears Brünings' name and the author's description of it is taken from Kobrak and Jansen's book. It is quite apparent that the end point of the passing of nystagmus is indefinite on account of gradual disappearance. Some are not altogether satisfied with Bárány's mass stimulation and the timing of the duration of the nystagmus, and they believe that much more can be learned from the use of mininum stimulus and from the observation of the time elapsed before reaction begins.

The author gives a translation of Kobrak's description of the test. The head is bent backward about 60 degrees and slightly inclined toward the shoulder of the douched side. In this position, which is best because the horizontal canal is most nearly vertical, the circulation of the lymph is possible. Stress is laid on selecting an optimum position of the horizontal canal because this canal by its anatomic position is nearest the source of the temperature change, being most externally placed. Water at 82 F. is then allowed to flow slowly into the ear until the first twitchings of the eyes start. This weak initial nystagmus is often hard to perceive, but will gradually become stronger after washing has started. This raises the question whether these initial twitchings of the eyes show merely the beginning of the reaction or whether the reaction has already started during the washing. Kobrak has overcome this by starting the douching with 5 c.c. of water, after which he waits a few seconds to see if any weak nystagmus appears. Sould there be no reaction, he advises waiting at least one minute in order to allow the small currents of lymph or other occurrences of reaction to come to rest again. Then try with 10 c.c., and if no reaction is obtained a pause of at least five minutes is made in order to let the lymph circulation and the irritation of the vestibule cease. Then try with 20 c.c. and if a reaction should occur try between 10 and 20 c.c., using 15 c.c. If again there is a reaction, try between 10 and 15 c.c. If no reaction try between 15 and 20 c.c. In this manner the exact number of cubic centimeters necessary to produce a reaction is found. The threshold is sharply defined, an addition of 2.5 c.c. of water to that previously used often being sufficient to pass from the subminimal to the minimal stimulus in the normal labyrinth. The author reports a series of twelve cases with detailed findings by this test, together with the conclusions reached in each case.

RADICAL MASTOID OPERATION FOLLOWED BY PARESIS OF THE SEVENTH, FIFTH, AND A PORTION OF THE THIRD CRANIAL NERVES WITH RECOVERY. H. W. LYMAN, Ann. Otol., Rhinol. & Laryngol. **34**:265, 1925.

The author reports a case of a young woman, aged 18, who underwent a radical mastoid operation with Bárány modification, and who developed, seventy-two hours later, a paresis of the seventh, fifth and a portion of the third cranial nerves. The patient had always been perfectly healthy, except for a right sided chronic otitis media of ten years' duration. This came on originally from swimming and the discharge had only been at intervals. Dr. Bárány demonstrated his modification of the radical operation on this patient. The antrum and tympanum were both found to contain considerable cholesteatomatous material. There was nothing unusual in the findings or in the operative procedure. On the morning of the third day following operation the patient noticed an irritation of the right eye with continuous lacrimation. No cause could be found for this. In the afternoon a laxness of the right side of the face was noticed and the patient complained of a peculiar sensation on that side with numbness. When the mouth opened the jaw deviated to the left and the patient could not abduct the jaw to the right. Two days later facial paresis was complete. Two days following this there was a paresis of the levator palpebrae superioris and the superior rectus of the right eye, both of which are supplied by the same branch of the oculomotor nerve. The ear condition cleared up uneventfully in two or three weeks and there was a complete recovery from the paresis a few weeks later.

The paresis of the seventh nerve, coming on seventy-two hours after the operation and clearing up completely in the course of a few weeks, presents no point of especial interest, but the author is at some loss as to how to explain the paresis of the other nerves. He believes that infection traveling along the connections between the two nerves probably set up neuritis of these correlating branches. Of the numerous connections between the fifth and seventh nerves, the structures in the carotid canal seem to offer the most probable pathway of infection in this case. There was considerable curetting in the anterior part of the tympanum and there are frequently dehiscenses between this cavity and the carotid canal. The deviation of the lower jaw would suggest that the motor root of the fifth was not paralyzed but was irritated sufficiently to keep the muscles supplied by it in a state of contraction. Whether the paralysis of the superior branch of the third nerve was affected through the sympathetic branch from the cavernous plexus or by its propinquity to the Gasserian ganglion, the author ventures no opinion.

SNAPP, Grand Rapids, Mich.

THE FINER STRUCTURE OF THE LIGAMENTUM SPIRALE. JOSEPH FISCHER, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:1 (March 14) 1925.

As the function of the ligamentum spirale is not completely clear, it can be assumed that it serves an acoustic function, perhaps by preventing a resonance which is not desired. For this purpose only a part which is tense could be considered, namely, the ligamentum spirale proper. The thought cannot be ignored that a functional relation to the accumulation of fluid in the spiral ligament exists. We can imagine that the degrees of tension, especially of the radial part of the ligamentum proper, changes according to the degree of the accumulation of fluid, so that the fibers of the ligament become more tense or relax. The rest of the spiral ligament could be considered a suspending factor for the blood vessels.

RELATIONS OF EYE AND EAR IN DEAF-MUTES AND IN BLIND DEAF-MUTES. FISCHER and SOMMER, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:10 (March 14) 1925.

The functional examination of the labyrinth has lately come to the fore, whereas formerly only the pathology of the cochlear apparatus was considered. The material in a deaf-mute institute in Vienna is of special interest, on account of the prevalence of hereditary-degenerative types. The more modern investigators have examined the whole organism and they have correlated the otologic examination and the systemic changes. Hammerschlag has discussed minutely the question of the family, of heredity, degeneration and mental inferiority. So far, especially two points interested the otologist and the ophthalmologist, namely, the vision of the deaf-mute and the degenerative stigmas of the eye. With the development of the physiology and pathology of the labyrinth, new questions come up. The authors discuss:

1. The degenerative factor and the inferiority of the eye and the ear.
2. The relation of strabismus and heterophoria to the labyrinth.
3. The nystagmus in end-position.
4. The phenomenon of convergence in deaf-mutes.
5. The prognostic importance of the examination of the eye and ear.
6. The importance of an exact examination of the ear and eye in relation to instruction of the deaf-mute.
7. The results of the newest clinical methods of examination in deaf-mutes, namely, auro palpebral reflex, minimal irritation according to Kobrak, arm tonus reaction, experimental optic nystagmus, cylinder skiascopy.
8. The deaf-mute blindness.

Lately, Alexander and Fischer classified the cases from the etiologic point of view: "The constitutional hereditary-degenerative form comprises all cases of intrafetal deafness with multiple deaf-mutism in the family and other degenerative symptoms in the ascendancy, numerous stigmas and perhaps mental abnormalities. Many classic cases of this nature are found in asylums for the feebleminded as mentally inferiors, or, as cases of idiotic inner ear affection. In a small number of cases of this category, considerable hearing may be present at the time of birth. This is lost spontaneously or through sickness. These cases comprise the group of postfetal constitutional hereditary-degenerative forms.

"Among the individually acquired inner ear acusticus affections, the syphilitic is the example of deafness acquired in fetal life. The positive Wassermann and somatic signs of hereditary syphilis determine this classification. The intrafetally acquired traumatic and acute infectious cases are classified by themselves.

"Among the cases of post fetally individually acquired inner ear acusticus disease, those cases are understood in which the originally normal hearing has been lost in a healthy and hereditarily free person by an intercurrent disease, such as trauma, meningitis or other acute or chronic infections. The difference in the nomenclature of 'postfetal manifest' and 'postfetal acquired' is based on the following:

"If deafness becomes postfetally manifest, it is understood that a new etiologic moment has not appeared, but the intrafetally effectual etiologic factors appeared postfetally. In postfetally acquired deafness a new etiologic factor appears. A third group must be added to these, a group in which a distinct hereditary-degenerative condition is present and in which a new disease has

caused the more or less complete loss of hearing. In this group the inferiority of the hearing organ plays a deciding part. Such an inferior hearing organ falls more easily a victim to hereditary syphilis, trauma and general infections.

"Alexander and Kreidl observed two children, whose parents were related before they married. Both children had had normal hearing but both became deaf after scarlet fever. The lowered resistance was responsible. The cases of postfetal deafness after rickets in hereditary degenerative persons belong to this group."

Concerning the importance of a careful examination of the ear and eye in relation to the instruction of deaf-mutes, Fischer and Sommer remark that it is important for the teacher to learn whether a child has still rests of hearing and in which region of the tone scale these rests are located (Bezold, Denker).

The teacher builds on this basis. The child above all must understand the motions of the mouth and the variations of gestures, in order to learn the spoken word. It must see the blackboard, because the child perceives only through pictures that which the normal child receives by hearing. The schoolroom must be properly lighted. The children must be grouped so that all can see well what is taught. The feebleminded need special attention. It is of importance for the teacher to know why a pupil does not see well. Anomalies of the eye must be quickly corrected and lasting disease conditions must be ameliorated as soon as possible. Refractory anomalies, especially astigmatismus, must be corrected by spectacles. If an improvement cannot be achieved, the teacher can arrange the instruction according to circumstances. An exact examination of the ear and eye is important for the pupil when he goes out into the world to earn a living (Alexander, in "The Handbook of the Choice of a Vocation," Urban and Schwarzenberg, 1924).

Children with progressive eye diseases or with a considerably diminished vision should be prevented from following a calling for which the vision is not adequate. This is especially important, because a change in vocation is especially hard for deaf-mutes. For an exact refraction, the cylinder skiascopy according to Lindner was used. The authors think that this method is the only correct one for deaf-mutes.

AMBERG, Detroit.

Pharynx

TREATMENT OF FIBROMAS OF THE NASOPHARYNX. GORDON B. NEW and FRED A. FIGI, Ann. Otol., Rhinol. & Laryngol. **34**:191, 1925.

During the last fourteen years, thirty-two patients with fibromas of the nasopharynx have been examined at the Mayo Clinic. The authors report excellent results in these cases with the use of radium. The treatment was applied by three different methods. In the first or early cases the radium was applied in a T shaped lead applicator containing 50 mg. of radium held in various positions against the tumor in the nasopharynx. It was difficult to apply the radium accurately in this manner and there was a severe reaction in the surrounding structures. In the second group, steel points, containing the radium emanation or the element, were inserted directly into the tumor. Three or four points were usually inserted depending on the size of the mass. In the third group of cases, which includes the more recent ones, emanation seeds, averaging 0.5 to 1 millicurie each, were implanted directly into the growth, the number depending on the size of the tumor. Such treatments are repeated in from six weeks to two or three months, depending on reaction and the

result of the previous treatment. The number of applications required in the cases now cleared up varied from two to nine.

The authors believe that surgical treatment of these cases is rarely indicated. The severe hemorrhage which accompanies such operations makes them hazardous. Radium is advocated as being the treatment of choice. With its use the usual operative mortality is eliminated. In most of the authors' cases the tumor cleared up entirely, and in the others it was held in check during its period of activity.

SNAPP, Grand Rapids, Mich.

THROAT INFECTIONS IN CHILDREN. JOSEPH BRENNEMAN, Arch. Pediat. **42**:145 (March) 1925.

Throat infections in children form a considerable and important part of pediatric practice and are of interest on account of the almost infinite variety of their sequelae. Any and every throat infection may initiate a series of pathologic changes that may involve almost any part of the body. These infections occur sporadically and in epidemic form, are very contagious, possess a decided individual and familial selectivity, and, owing to the fact that they confer no lasting immunity, present a high incidence of recurrence. The author mentions as predisposing factors the smoke and dust of modern automobile traffic, the increasing intimacy of contact in our daily life, our habits of living in superheated houses with the consequent wide variations in temperature to which the respiratory tract is subjected in winter, and meteorologic conditions.

Many organisms are responsible for throat infections, and of these the streptococcus seems to play the leading part. The constant manifestations in any given epidemic and the varying manifestations in different epidemics lead us to assume that various organisms are active at different times, or that the same organism has variable degrees of virulence or selectivity, or that other organisms associate themselves with the primary one. Under these conditions the average throat culture has very little significance.

The relationship between these infections and influenza is of considerable interest. They have, even in severe epidemic form, nothing in common with influenza except certain mutual symptoms, such as paranasal sinus or middle ear involvement, and yet severe throat infections are frequently termed influenza.

The vast majority of these infections run a relatively benign course but serious complications may develop. The author divides the latter into three classes. The first is composed of those patients in whom the infection apparently remains localized in the throat, but the temperature is high and unduly protracted. The author describes patients in whom the temperature ranged as high as 106 F. daily for periods of five to seven weeks, with no other evidence of infection than a sore throat. Almost any kind of diagnosis may be made in such cases, from typhoid fever to tuberculosis and sinus thrombosis.

The second group is composed of those cases in which the throat infection involves adjacent tissue, spreading by continuity and contiguity. In this group we have involvement of the retropharyngeal lymph glands with the formation of retropharyngeal abscess, peritonsillar abscess, cervical adenitis, otitis media with all its intracranial complications, involvement of the accessory nasal sinuses, invasion of the trachea and larynx with occasional edema of the glottis, and almost any type of lung pathology.

In the third group, the author includes those in whom the infection becomes systemic and produces, through toxin or bacteria in the blood stream, pathologic changes in almost any part of the body. One of the commonest systemic

complications is arthritis. Osteomyelitis, nephritis, nephrosis, pyuria and cardiac conditions, such as endocarditis, myocarditis, pericarditis and chronic valvular disease may also result. Various cerebral conditions such as thrombosis, encephalitis, meningitis, and abscess may occur from hematogenous infection. True pyemia may supervene and various types of skin rashes, scarlatinaform in type, often lead to confusion in diagnosis.

The author mentions one type of infection that apparently centers in the abdomen, and which is accompanied by sudden high temperature, vomiting, and diarrhea. The condition probably is one of true gastro-enteritis with an inflammation of the intestinal mucous membrane. Abdominal pain is sometimes present and is referred either to the umbilicus or to the lower right quadrant, in which case the exclusion of appendicitis is quite difficult.

The diagnosis of these conditions is based on the history of cough, cold or sore throat, the examination of the throat itself, the fact that an epidemic of such infection is present, the fact that other members of the family are afflicted with the disease in a more evident manner than the patient himself, and the fact that certain complications such as otitis media, cervical adenitis, or laryngitis, which come only from throat infection, are present.

The relation of the tonsils and adenoids to these infections is of interest. The author feels that adenoidectomy is indicated at any age in which there is mouth breathing, repeated infection, insidious deafness or any evidence of disturbed nasal breathing. The tonsils have a definite function in early childhood and should not be disturbed unless clear indications are present. It is not plain whether throat infections first localize in the tonsils or in the mucous membrane but the author feels that, in small children, the tonsil is not the portal of entry but that it is the mucous membrane which is principally involved, these mucous membrane infections being most marked in patients having the so-called exudative diathesis of Czerny. This is the explanation for the fact that tonsillectomy performed under 4 or 5 years of age does not give relief from upper respiratory tract infections, and that cough is even more frequent and more violent after operation than before.

In the older child, the tonsil does not deserve as much consideration as that of the younger and, while results are often brilliant, disappointments are common. Recent statistics would indicate that tonsillectomy does not have the definite beneficial effect on the so-called rheumatic syndrome as we have been led to believe.

The author closes with the point that it is the general practitioner and pediatrician, who has followed the patient over a long period of time, who is best qualified to pass on the indications for tonsillectomy, and not the otolaryngologist, who sees the patient only once or twice, usually during, or immediately after, an acute infection.

EFFECT OF TONSILLECTOMY ON THE HEALTH OF ONE THOUSAND TWO HUNDRED CHILDREN. ALBERT D. KAISER, J. A. M. A. **83**:33 (July 5) 1924.

Tonsillectomy has become such a universal procedure that the indications for its performance are often indefinite, and the effect of the operation over a period of years has been so seldom followed that the end-results are not known. The author has made a study, one and three years after operation, of 1,200 children who were subjected to tonsillectomy, and has compared the health of these children with that of 1,200 children who presented similar indications for operation, but on whom operation was not performed. Both groups of children were subjected to careful physical examination before

operation, at the end of one year and at the end of three years. An analysis of these statistics reveals some interesting facts.

Localized disease, due to pathology of the adenoid and tonsil, such as mouth breathing, frequent sore throat, and frequent head colds, showed a very marked improvement as a result of the operation, the improvement being more marked at the end of the first year than at the end of the third. Mouth breathing was relieved in 88.5 per cent. of the operated cases, and in those who failed to receive relief, incomplete removal of the adenoid was found in about 44 per cent., and definite nasal obstruction in more than 50 per cent. Laryngeal infections were neither prevented nor benefited by the procedure.

The relationship between enlarged cervical glands and diseased tonsils has not been definitely established, owing to the fact that other factors must be taken into consideration, such as infected teeth and ears, and skin infections. In these studies, however, cervical adenitis was definitely improved, the greater improvement being noted in the cases of comparatively slight enlargement. This result was often not demonstrable for a considerable period of time after operation.

The nutritional state of the children was improved.

Otitis media, either acute or chronic, was benefited, the incidence of this disease being less after operation than before.

The incidence of bronchitis or pneumonia was not influenced by the procedure.

Diphtheria was less frequent after operation.

The incidence of scarlet fever and measles was not changed by operation, but the course of these diseases did not seem to be so severe in those operated on as in those not subjected to the procedure.

Chorea, joint pains, growing pains and rheumatism were not affected by the procedure.

There was a lessened incidence of cardiac disease after operation, and it is hoped that the lessened incidence of throat infections will make this result more noticeable with the progress of time.

Study of the statistics of the control group demonstrated that 69 per cent. of these children were still complaining of mouth breathing, as compared with 11 per cent. of the operated group. The incidence of tonsillitis and sore throat in the control group had diminished in the three year period, but was still much higher than that of the operated group. Frequent head colds were present in about one-half of the children not operated on; of those operated on approximately two-thirds had secured relief from infection. Tonsillectomy and adenoidectomy definitely lessened the incidence of head infection but offered no guarantee against their recurrence.

Other interesting facts brought out by the study were the high incidence of nasal discharge in the control group, 45 per cent. of these children presenting this symptom, as compared with 5 per cent. in those operated on, and the greater frequency of palpable thyroids in the nonoperated group.

CONNOR, St. Paul.

Larynx

THE TREATMENT OF TUBERCULOUS LARYNGITIS WITH CHAULMOOGRA OIL. CLAUDE L. LARUE, Ann. Otol., Rhinol. & Laryngol. **34**:122, 1925.

No rapid progress has been made or brilliant results obtained in the treatment of tuberculous laryngitis. This is largely due, in the mind of the author, to the lack of early diagnosis, and to the indifference on the part of the physician,

because of his ignorance as to the curability of the disease and because of his fear of being contaminated by the patient. Until these factors are overcome, no great progress can be made in the treatment of this disease. However, encouraging results have been obtained by the use of chaulmoogra oil by many different laryngologists, the review of whose work with this method is included in this report. In the author's series of 21 cases treated in this way, good results were also obtained. The technic used, was, in the main, that set forth by Lukens and described, together with the report of results in 60 cases, in 1921. This consists in the intratracheal and intralaryngeal injection method, dropping in, drop by drop, 1 c.c. of 10 or 20 per cent. solution of chaulmoogra oil in olive oil, the treatments being given two or three times a week. Some of the patients were under treatment for many months. All of those in Class A, which included patients having only vascular changes of the laryngeal mucosa, completely recovered, as did all of those in Class B, which included those having induration or ulceration added to chronic vascular changes. Class C cases were characterized by necrosis with marked infiltration, decreased mobility and pain. This group all showed marked improvement. Two of them died from pulmonary tuberculosis, but showed continuous laryngeal improvement regardless of progressive involvement of the lungs. Voice rest, together with general care under the supervision of an internist, of course must accompany any local treatment.

SNAPP, Grand Rapids, Mich.

LARYNGEAL APPLICATION OF EPINEPHRIN IN GRIP CROUP. W. ARNOLD, Monatschr. f. Kinderh. **28:** (Sept.) 1924.

Arnold reports the local use of epinephrin in the so-called "grip-croup" to control the laryngeal stenosis, and in case of doubt to differentiate between simple laryngitis and laryngeal diphtheria. In the laryngitis of grip, the stenosis is due to hyperemia of the small vessels and stasis, with little or no exudation but with occasional necrosis of the mucous membrane. The author utilizes the vasoconstrictor action of epinephrin in reducing the hyperemia and stasis.

Failing to secure any result from the inhalation of epinephrin, or its subcutaneous injection, the author saturated a small cotton pledget with from 0.5 to 1 c.c. of 1:1,000 epinephrin and introduced it into the larynx, using the technic of intubation. Slight pressure expressed the epinephrin, which reached the cords and deeper portions of the larynx, its successful application being indicated by cough. Excess of pharyngeal mucus should be removed.

The author found, in cases of simple laryngitis of grip, that relief from dyspnea occurred, usually in fifteen minutes, and as the result of one application. In two cases, in which the procedure failed, a diphtheritic membrane was present and intubation became necessary. The author points out that failure in the latter cases was due to the fact that diphtheria is an exudative process and not a simple edema of toxic origin, as in grip, and suggests that this procedure may be used in case of doubt to differentiate between simple laryngitis and laryngeal diphtheria.

CONNOR, St. Paul.

Nose

THE DEVELOPMENT OF NASAL POLYPI. OSKAR HIRSCH, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11:**78 (March 14) 1925.

Hirsch makes the following statements:

1. Rare forms exempted, the inflammation of the accessory cavities can be classified as purulent and catarrhal. The suppurative inflammations are char-

acterized by secretion of pus and moderate swelling of the mucous membrane; the catarrhal inflammations by a pronounced swelling of the mucous membrane, frequently without secretion.

2. Polypi can follow only a catarrhal inflammation. The primary polyps are created by a catarrhal rhinitis. These are more rare and do not show an inclination to recur. They are situated at the loose tissues of the nose, not unconditionally at the ostia. The catarrhal inflammation of the accessory cavities creates the secondary or recurring polyps. This is the kind more frequently encountered.

3. The polyps have essentially the same histologic quality as the catarrhally inflamed mucous membrane of the accessory cavities.

4. Recurring polyps are the objective symptom of a catarrhal inflammation of the accessory cavities, and therefore allow the conclusion that one or more accessory cavities are affected by a catarrhal inflammation. The location of a polyp shows which cavity is inflamed. Polyps in the middle meatus point to a catarrhal inflammation of the maxillary antrum, the frontal sinus and the anterior ethmoidal region. Polyps in the fissure point to a catarrhal inflammation of the sphenoid and the posterior ethmoid region.

5. The recurring polyps develop through propagation of the catarrhal inflammation of the accessory cavities from the cavities into the nose (majority), or through incarceration of a part of the swollen catarrhal mucous membrane of the accessory cavities in the respective ostium (minority).

6. The most frequent place for the origin of recurring polyps is the maxillary antrum and not the ethmoid as has been assumed heretofore. The polyps usually are situated at the ethmoid, but only because the exit from the maxillary cavity leads through the ethmoid.

7. Polyps, contrary to the generally accepted view, may undergo involution (rare occurrences).

RIGHT SIDED TYPICAL CHOANAL ATRESIA IN CONNECTION WITH CONGENITAL ARRESTED DEVELOPMENT OF THE FACE. KLAUS VOGEL, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:121 (March 14) 1925.

The genesis of congenital choanal atresia is still under discussion. In spite of the fact that over 100 cases have been described which make it very probable that a typical intra-uterine disturbance of development is present, Zarniko questions the congenital origin. Vogel describes a case of right-sided choanal atresia which was combined with several positively congenital disturbances on the same side of the face and for which it is most reasonable to assume that the cause is intra-uterine. In a female patient, aged 15 years, an osseous occlusion was found. There was a complete occlusion which could be demonstrated by inflation with Politzer's air bag. Only very fine bubbles appeared from the nasal tear duct. The floor of the nose was higher on the right than on the left side and it ascended still higher posteriorly. The lower turbinate was higher on the right side than on the left and was developed only anteriorly. It was small and ridgelike. The hypertrophied mucous membrane was like a papilla. A small but characteristic turbinate was encountered in a high location. The turbinates were abnormally short in a sagittal direction. The septum was straight. The roentgenogram showed increased thickness of the lateral nasal wall, a diminution in the size of the right maxillary antrum and a high situated right nasal floor and right turbinates. The right sphenoidal cavity was smaller than the left in the roentgenogram, which was taken through

the mouth. The right ala nasi was less developed than the left. Somewhat laterally, a blind fistular duct was found. The forehead was equal on both sides. The palate was asymmetric and the uvula split. The patient, who is an imbecile, never noticed increased perspiration or headache on the right side, but she could not smell on this side. The Wassermann reaction was negative.

The most varied ideas exist concerning the origin. Hopman considered the occlusion to be only the highest degree of a stenosis which is not rare. Luschka assumed a proliferation of the horizontal, Kundrat and Schroetter of the vertical part of the palate. Von Hansemann considered the atresia a variation of bone formation, Hochstetter assumed a persistence of the bucconasal membrane, whereas Haag cautiously thought it to be only a disturbance of the normal development of the nasal cavity. Berblinger looked at the atresia as a consequence of an abnormally increased and abnormally directed development of the osseous parts which surround the choana. The period of development is from the sixth to the twelfth fetal week, according to Berblinger. The coexistence of an atresia of the choana with other congenital malformations in his case, and in other cases reported in the literature, must perhaps be considered not a mere coincidence but a hint that the atresia is also congenital.

Von Eicken advised the following procedure. The vomer is removed submucously and the nasal mucosa is separated at this spot from the occluding plate. The plate is removed with a few blows of the chisel and the occluding membrane and the posterior third of the septal mucosa are excised on both sides. In this manner a large cavity is produced which remains open permanently. In Vogel's patient, the occluding plate was too thick to be removed entirely, therefore only a large opening was made at the posterior portion of the septum. Six months after the operation the opening proved to have remained sufficiently large.

THE INTRANASAL OPENING OF THE FRONTAL SINUS. AURÉL RÉTHI, Ztschr. f. Hals-, Nasen-u. Ohrenh. **11**:135 (March 14) 1925.

Réthi states that 12 years ago he recommended a procedure similar to that of Gumperz (published in the Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:291). The only difference is the approach, which makes Réthi's simple procedure more difficult and complicated. Réthi's method was published in the "Transactions of the Society of German Laryngologists, 1913." Fletcher Ingals widened the naso frontal duct by a burr. His method is not entirely without danger because the lamina interna can be injured. Halle recommends an instrument which protects the internal table; he now perforates the floor of the frontal sinus with a burr and finishes his operation with a pear shaped burr. This operation is rational but is not popular because an accident can easily occur, although in Halle's hands it is without danger. What must be removed, asks Réthi, in a broad intranasal operation? The crista nasalis, a massive ridge must be removed.

Réthi proceeds as follows. Under local anesthesia (cocain epinephrin) the anterior portion of the lower turbinate and the anterior ethmoid cells are removed. The entrance to the frontal sinus is widened as much as possible with Hajek's hook and curets, perhaps also with files. A little cocain is sprayed into the cavity. A plug with cocain is put into the nose and outwardly the root of the nose and the lateral portion of the nose are infiltrated with a 1 per cent. procain solution to which a little epinephrin is added. With a chisel, bent backward, the crista nasalis, the lateral nasal bone and the frontal process are chiselled through, from within, outward toward the face. With a

Jacques-Joseph elevator, the skin is loosened from the bone. Attention must be paid to the tear sac. Then Réthi's new strong forceps (which are similar to Jansen's septum forceps) are used, by the aid of which the bone is removed as far laterally as possible. This can easily be done. Only small portions of bone are removed at a time. After removal of the crista nasalis, one must not go too high. The bone in the region of the crista nasalis can be thinned with a chisel bent outward. The rules expressed by Gumperz apply also to Réthi's method. The field of operation is roomy and can clearly be seen, the hammer and chisel are used sparingly and the chisel is not applied perpendicularly to the skull.

Réthi cuts a window under the frontal process intranasally, and does not make a large wound. Réthi's approach is intranasally, Gumperz's is extranasally. Réthi claims that the method of Gumperz is more difficult than his. Réthi employs a flap, according to Halle, consisting of mucous membrane and periosteum. The curved incision begins at the roof of the nose and ends below the anterior portion of the middle turbinate. At the roof of the nose it goes near to the apertura pyriformis and then downward and backward, corresponding to the margin of the apertura pyriformis. The anterior insertion of the middle turbinate is detached with a Struyken forceps from its base and pushed to the median side. Then the anterior, and, if necessary, also the posterior ethmoid cells are removed. The entrance to the frontal sinus is laid bare and is widened with hooks and curets. With a bent chisel the processus frontalis is chiseled through and the opening is made so large that instruments can enter easily. A slender elevator is guided through the window, and the skin of the root of the nose is carefully loosened. The crista must be removed, as has been described, laterally if possible. If the bone is hard and thick it is advisable to pare it down.

AMBERG, Detroit.

Miscellaneous

FURTHER REPORT ON SYNERGISTIC ANALGESIA AS EMPLOYED IN CASES ABOUT THE HEAD AND NECK. JOSEPH C. BECK, HARRY L. POLLOCK and FRANCIS L. LEDERER, Laryngoscope **35**:181, 1925.

Excellent results in the use of synergistic analgesia are reported by the authors, who have used it in a large series of cases extending over a period of four years. They believe it to be practically an ideal anesthetic and especially adapted for work about the head and neck as it eliminates an excessive number of hands in the operative field. It is of especial value in plastic surgery of the face, when it is of the utmost importance that the anesthetist's manipulations should not transgress the rigidly aseptic field which such work demands. The avoidance of shock to the patient is an exceedingly valuable factor in any anesthesia and in the type described it is practically eliminated, as the patient receives his induction of analgesia gradually in his own room.

In the consideration of the technic of synergistic analgesia, one is concerned with certain fundamentals in its administration. The dosage is guided mainly by the age, weight, general condition and mental makeup of the patient. However, the average dose for every 50 pounds of body weight is one-eighth grain of morphin sulphate, combined with 2 c.c. of a fresh, sterile, chemically pure magnesium sulphate solution (50 per cent.), and 2.5 per cent. procain; equal parts of olive oil and ether (each 1 oz.) and 1 dram of paraldehyd (U. S. P.). For the average person, weighing from 135 to 150 pounds, three doses are usually required. The morphin-magnesium sulphate combination is given intramuscularly, deep into the gluteal region or subcutaneously at

one-half hour intervals between each injection. Then, one-half hour following the last hypodermic injection, the rectal administration is begun. Because of the discomfort that results from the introduction of fluids into the rectum, this part of the procedure should be done slowly and in small amo nts, taking about twenty minutes to introduce the entire quantity. Proper environment is then supplied by dimming the lights and by guarding against disturbance of the patient.

The important factor in synergistic analgesia is the action of the various drugs in association with each other. The morphin renders the magnesium sulphate much less toxic and greatly increases its analgesic and anesthetic action, while the magnesium sulphate in turn seems to hold the morphin in contact with the tissues for a longer period and this enhances its analgesic action. Experiments show that magnesium sulphate is capable of reducing or completely inhibiting the symptoms of excitation which often follow the injection of morphin. The addition of 2.5 per cent. procain to the combination is said to increase the analgesic potency of the solution approximately 25 per cent. These three ingredients are now put up together in 2 c.c. ampoules ready for use. The authors hope by this report to stimulate further investigation into the use of this valuable anesthetic.

SYNERGISTIC ANALGESIA IN HEAD SURGERY. JAMES J. KING, Laryngoscope **35**: 200, 1925.

The combination of magnesium sulphate, morphin and procain given intramuscularly in conjunction with local anesthesia in head surgery, has given excellent results in the hands of the author. For the average individual, weighing from 130 to 150 pounds (from 59 to 68 kg.), three injections are usually required. Three hours before the operation is to take place, 2 c.c. of sterile 50 per cent. solution of magnesium sulphate combined with 2.5 per cent. procain and one-eighth grain morphin is administered intramuscularly deep into the thigh, deltoid or subscapular region. The lights should then be dimmed, the patient kept quiet and the surrounding conditions made conducive to relaxation. The intramuscular injections are repeated at half-hour intervals until two or three doses have been administered, as may be required by the individual patient. One hour or one hour and a half after the last injection, the patient should be carried to the operating room on a stretcher and transferred to the operating table with the least effort on his part. With this preliminary medication and routine, the author has performed 100 tonsillectomies, in which 0.5 per cent. procain solution was infiltrated around the tonsils. In about twenty additional patients, the tonsils were removed without the aid of local infiltration or general anesthesia. In six patients one tonsil was removed after injecting in the usual way with 0.5 per cent. procain, while the other tonsil was removed without the aid of any local injections. In some cases of peritonsillar abscess, the tonsils were enucleated without pain under synergistic analgesia without local infiltration. The author has used this method of anesthesia in tonsillectomies only, but he believes that it may be employed successfully in all ear, nose and throat operations in which a general anesthetic is either contraindicated or is not desired.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Regular Monthly Meeting, April 6, 1925

E. P. Norcross, M.D., *President, in the Chair*

Laryngotomy and Laryngectomy Case Exhibition. Presented by Dr. Joseph C. Beck and Dr. Harry L. Pollock.

Dr. Beck: We have several patients with laryngotomy and laryngectomy who have been shown before. They are presented now because they have remained free from recurrences and also because a voice has been added by the use of an instrument perfected by Dr. MacKenty.

Case 1.—Mr. F., aged 62, was first seen in October, 1921, with complaint of difficulty in breathing and hoarseness of two years' duration. In June, 1920, a thyrotomy was performed at another clinic and the growth was removed, which proved to be carcinomatous. There was a recurrence soon afterward, and in May, 1921, he returned to his laryngologist and was informed that further surgical measures should not be attempted, but that radium and roentgen-ray treatment should be employed. At our first examination we found a carcinoma growing through the thyroid incision and extending externally. There was so much difficulty in breathing that an immediate tracheotomy was performed. On November 9, under synergistic analgesia, a laryngectomy was performed. The patient had a stormy convalescence complicated by two severe attacks of erysipelas. But with this exception, he made a speedy recovery. In February, 1922, he was discharged from the hospital, having gained about 40 pounds (18 kg.). Up to the present time, there has been no evidence of recurrence. The patient has had this instrument (MacKenty) for aiding the voice but a short time, and, so far, is not able to use it satisfactorily. However, at times he can make himself clearly understood and probably with practice he will have a good voice.

Case 2.—Mr. S., was first seen on Feb. 12, 1925, with a history of hoarseness of four months' duration. On January 16, he had his tonsils removed. Examination revealed an irregular mass on the left cord, with some whitish deposits. Direct suspension was somewhat difficult, and a specimen obtained by this method was reported by the pathologist to be a fibropapilloma with no evidence of malignancy. On account of this finding, laryngotomy was performed under synergistic analgesia on March 11, the growth was thoroughly excised and the wound closed. This specimen, which was sent to the laboratory, was returned with the report of "squamous cell carcinoma." On March 19, a laryngectomy was performed, but the larynx had to be removed in two pieces owing to the previous laryngotomy. The man is in good condition and receives nourishment through the duodenal tube which is carried through the nose.

Case 3.—Mr. H., aged 70, was first seen on July 22, 1921, with a history of hoarseness of eleven months' duration. Examination revealed a growth on the right vocal cord. On July 26, a specimen was removed by suspension laryngoscopy and the pathologic report of squamous cell carcinoma was made.

The patient received some radium treatment, also a course of deep roentgen-ray therapy, which apparently made no impression on the carcinoma. On September 15, under synergistic analgesia, a laryngotomy was performed and the growth was excised. The incision was closed primarily and the patient made an uneventful recovery. It is now about three and one-half years since the laryngotomy was done. The patient is in good physical condition and examination shows no recurrence of the growth.

Case 4.—Mr. B., aged 58, was operated on by Dr. Lynch in 1924, and as he is a resident of Chicago, was sent to us for observation. He is in excellent physical condition and at the present time is free from any recurrence. He has a MacKenty apparatus, but has had it only for a short time and is inexperienced in its use but at times has a distinct voice.

Case 5.—Mr. R., aged 70, was first seen by us in 1911. He gave a history of hoarseness, with an operation performed four months previously by Dr. Rhodes of this city, who operated by the indirect route and removed the growth. At our first examination a recurrence was found and a short time afterward a laryngotomy was done, the growth removed, with immediate closure of the external wound. During the first forty-eight hours he experienced quite a little difficulty in swallowing and breathing but this subsided without any further surgical interference and since that time he has had no evidence of recurrence. The pathologic specimen showed an adenocarcinoma with a great deal of connective tissue spread through it.

Case 6.—I simply desire to report this case, as the man is still in the hospital and did not feel like coming out tonight. He is 75 years of age, and was operated on three months ago following a microscopic examination of the specimen which proved to be a squamous cell carcinoma. The usual laryngectomy was performed under synergistic analgesia. He has had two complications: First, an osteomyelitis of the two upper ribs which resulted in large abscesses with final sequestration of the ribs; second, a paroxysmal tachycardia which at times became alarming. These attacks later came at less frequent intervals and for some time the patient has been entirely free from them. This case is too recent to prognosticate but at some future time we will give a further report on it.

DR. POLLOCK: *Case 7.*—Mr. J. D., aged 51, presented himself on Jan. 6, 1923, with a history of hoarseness of six months' duration, gradually increasing. We first saw him when the voice was almost gone. Examination showed an irregular growth on the left vocal cord anteriorly. Biopsy by suspension laryngoscopy on January 8, showed squamous cell carcinoma. On January 17, under synergistic analgesia, the larynx was exposed and the left thyroid cartilage removed. Through this opening the growth was dissected widely and the wound closed. There was no tracheotomy, and the patient made an uneventful recovery. He went to work but presented himself monthly for examination. On July 31, a small fistula was present in the skin just over the external incision, extending into the larynx, through which mucus was discharged. There was no evidence of recurrence. On April 15, 1924, the fistula was closed in the usual manner and up to present date, has remained so. Monthly examination shows no recurrence. He has been working the entire time and his voice, although a trifle husky, is good. It is now twenty-seven months since the operation and he has remained free from recurrence.

Case 8.—Mr. L. E., aged 54, presented himself on Jan. 22, 1924, with a history of hoarseness of eleven months' duration and some pain in the throat. He had been treated by a laryngologist for six months. Examination showed

an irregular growth on the left cord. Biopsy showed a squamous cell carcinoma. On January 28, under synergistic anesthesia, a window resection of the left thyroid cartilage was done. The upper rings of the trachea above the tracheotomy opening were not removed. He made an uneventful recovery, and was then given a course of deep roentgen-ray therapy and continued to give satisfactory reports until December 11, when he complained of difficulty in swallowing. A stomach tube passed on several occasions revealed constriction just at the upper opening. On Jan. 25, 1925, after continued difficulty in swallowing, esophagoscopy was done, showing a constriction about 2 inches (5 cm.) from the epiglottis. Edema was present but no signs of malignancy. From January 25 until February 17 the patient's condition remained about the same and a bougie was passed on several occasions to relieve constriction. On February 17, the patient returned, complaining of severe pain and loss of weight and it was impossible to pass a bougie. A duodenal tube was passed and the patient was fed by this method for some time. At that time the edge of the tracheotomy opening gave the appearance of a recurrence of the carcinoma and a biopsy made on March 10 revealed a recurrence. On March 23, the entire trachea was cut away with the radio knife, wide of the apparently affected area. At this time an esophagoscopy was done and a portion of the esophagus was obtained by the biting forceps, which microscopically proved to be nonmalignant. The patient's general health is fair, although we are still not sure that there will be no recurrence.

DISCUSSION

Dr. Joseph C. Beck said that fifteen or more years ago they did a few laryngectomies with fatalities immediately or soon after the operation. Most of the patients had lung or mediastinal complications and succumbed within a week or ten days after the operation. They then continued to perform the laryngotomies, but no matter what method was used most of the patients either showed recurrence or succumbed to metastases. Since Dr. MacKenty presented his method of laryngectomy and this has been added to the synergistic anesthesia, they have done practically nothing but laryngectomy. He believed the outlook for carcinoma of the larynx, when recognized early, should be encouraging, particularly to the younger men who are well trained in surgery. The operation of laryngectomy is not difficult if it is done under local or synergistic anesthesia and the outlook is not bad. With the use of the MacKenty instrument for speech, he was sure there was great hope in this field.

Dr. J. Holinger asked if there had been any symptoms of pain up in the side of the head in any of these cases.

Dr. Beck said that there had been no symptoms of this kind, that they were all intrinsic cases of laryngeal carcinoma, and the pain toward the head is present when it becomes extrinsic.

Dr. Otto J. Stein presented a patient who had suffered from cerebrospinal rhinorrhea, with disappearance of the symptoms under treatment.

A woman, Polish, aged 45, married, applied for relief of a nasal discharge coming from the left nostril. Two years ago she presented herself for treatment on account of some nasal obstruction and anosmia.

Examination showed a healthy looking woman of average weight. There was impaired hearing, accompanied by some tinnitus. Both drum membranes

were practically normal; the tubes were open; air conduction was somewhat reduced.

Tests disclosed that the Schwabach was somewhat reduced, the Weber was not lateralized and the Rinné was positive. The upper tone limit was lowered, the lower tone limit elevated. Whisper test for both ears was reduced about 20 per cent. Both middle turbinals were hypertrophied, with polypoid changes. The polypoid middle turbinals were operated on with a snare. Great improvement followed the operation; free breathing through the nose was established and the sense of smell was restored.

She stated that one year later a watery discharge appeared from the left nostril following a head "cold." At that time there were no accompanying symptoms, such as itching of the nose, sneezing, headache, vertigo or lachrymation. She visited several physicians and was under their treatment but the discharge never ceased, except for a period of a few days, when there was a decrease in the amount of fluid. This was while taking some "pills" which were prescribed. A renewal of this prescription given for the menopause failed to relieve the nasal discharge. Six months after onset of the discharge she consulted me. Examination showed a well preserved, healthy looking woman, not very nervous, holding a much soaked handkerchief to her nose from which was dropping a clear, colorless fluid. She stated that the fluid never ceased but varied in rapidity especially on changing the position of her head. With the head forward or far backward the flow increased. It always came from the left nostril, soaked the pillows and towels at night and flowed into the throat, where it was swallowed. Many handkerchiefs were used each day, but after drying remained soft and pliable. There was an accompanying slight headache, which was not influenced by the amount of the flow from the nose. The blood pressure was 110 systolic. The eyes showed a mixed astigmatism. Roentgen-ray examination of the head showed all sinuses clear. A test tube full of the dripping fluid was collected in a few minutes' time and sent to the laboratory, where examination showed a water clear solution with no sediment. The Wassermann reaction was negative. There were no cells and no mucus, but traces of albumin and dextrose by both the Fehling and Benedict tests were found on two occasions.

Atropin internally had no effect. Alcohol injection of the left Meckel's ganglion was performed with no result. Benzyl-benzoate solution, 20 drops three time a day was administered and after two weeks the discharge had almost ceased, after three weeks it entirely disappeared and there had been no recurrence in about five months. The patient had a feeling of well-being and no increase in the headache.

This disorder is comparatively rare. Dr. Stein has observed four cases in the last thirty years. Two were of traumatic origin, and both terminated fatally. In the other two the cause was unknown. Its etiology in the non-traumatic cases is obscure. It is possible that meningitis, hydrocephalis and brain tumor play a rôle in its causation. The discharge may persist for months or years without complete cessation. The fluid has no viscosity, a faint alkaline reaction, a specific gravity of about 1.005; it contains about 1 per cent. of solids, consisting of globulin, albumose, dextrose, potassium salts, phosphates and urea and a few lymphocytes may be present. One must differentiate this disorder from other forms of rhinal hydrorrhea. In the latter there is usually itching of the nose, sneezing, the discharge ceases while asleep, the handkerchiefs become stiff on drying, the fluid has a viscosity, appears thick and sticky, opalescent, precipitates mucus and mucin and does not reduce by any of the sugar tests.

The treatment that has been suggested and employed includes lumbar puncture, roentgenotherapy and the internal administration of thyroid extract, atropin or benzyl-benzoate.

DISCUSSION

Dr. Joseph C. Beck said that he saw a woman who was injured in an automobile accident. Following this, she developed a cerebrospinal rhinorrhea, but was perfectly comfortable when her head was held back. If she leaned forward the discharge occurred. He had seen two cases dissected by Chiari which showed deficiency of the cribriform plate, in which a fistula occurred and never closed.

Dr. Harry L. Pollock recalled the fact that he presented a very similar case before the Society in 1924. The patient was a young woman who was perfectly healthy. At a party she danced a good deal and the next morning noticed that her nose was running. This was continuous except when the head was held in the erect position. She consulted him because of a cough at night, which was produced by the fluid running down her throat when she was lying down. Careful examination showed the fluid forming at the cribriform plate. He looked up the literature on the subject and instituted treatment with potassium iodid. After a few months the discharge ceased and there had been no recurrence so far as he knew. The examination showed the discharge to be cerebrospinal fluid of low specific gravity.

Dr. Stein (in closing), said he thought everyone agreed that these cases were usually beyond relief. There may be a cessation of the discharge but it almost invariably recurs. Posture has had a great deal to do with the discharge in all the cases, and in his patient the discharge was worse with the head bent forward or back.

Specimen from Case of Ludwig's Angina. Presented by Dr. Alfred Lewy.

The patient from whom this specimen was taken was a man, aged 21, 6 feet, 4 inches tall, and well proportioned. He had a history of hemorrhagic effusion into the knee joint following a slight injury and various other bleedings, including hematuria. Two of his mother's brothers and two of her uncles were known as bleeders, and his brother also has a history of severe bleeding from slight injury. March 18, he was seen by a physician who diagnosed follicular tonsillitis. March 20, at noon, he was again seen by his physician, who then thought quinsy was developing. Dr. Lewy saw him that evening in consultation. At that time his tongue was forced up against the roof of the mouth by a hemorrhagic effusion into the floor of the mouth which extended down the right side of the neck. Breathing was becoming increasingly difficult, the patient holding his head forward in order to breathe. He was transferred to the hospital, where he was given three ampules of fibrogen subcutaneously and calcium chlorid intravenously. The blood clotting time was seventeen minutes before this procedure and remained about the same afterward. Tracheotomy had to be done with the patient sitting up and with his head projecting forward. In this Dr. Lewy had the advice and assistance of Dr. C. E. Kahlke. The trachea was reached at a depth of about 2 inches (5 cm.), and was opened just below the cricoid. The trachea was dislodged to the left, so that the intermuscular fascial planes could not be followed and because of the position of the head the thyroid isthmus had to be retracted downward out of the field. The longest tracheal tube available at the time was barely long enough to reach when pressed inward by the thumb, so a catheter was passed through the tube, which carried him through the night.

The next morning an extra long tracheal tube was procured which gave him fair breathing. A transfusion with whole blood was performed by Dr. Bernard Portis. The pulse, which had been barely perceptible, did not improve much and the patient died that afternoon.

The specimen showed an enormous infiltration of hemorrhagic fluid, filling the entire floor of the mouth; both pyriform sinuses were filled flush with the epiglottis which was folded on itself so as to close off the glottis; within the larynx itself was seen the same submucous hemorrhagic infiltration, and section of the tongue showed that it extended into the tissues of the tongue itself.

Although there was oozing all night from the tracheal wound, and there was some blood found in the bronchi, Dr. Lewy did not think, from the appearance of the viscera after death, that death was due directly to acute anemia or to suffocation, as the patient's breathing was quite free up to the time of death. He was inclined to the opinion that death was due to pressure on the vagi or to toxemia. The white blood cell count was 25,000. He had no report on the type of bacterial infection.

ROENTGEN-RAY FILM OF SUBMUCOUS IVORY IMPLANT FOR ATROPHIC RHINITIS. Presented by DR. HARRY L. POLLOCK.

A stereogram of a case of atrophic rhinitis in which a large piece of ivory was implanted in the septum submucously showed plainly the implant in the roentgenogram. Dr. Pollock stated that for some time past they had been using ivory implants for the correction of external deformities with good results, so he decided to try it in atrophic rhinitis. The patient showed marked improvement after the implant and at this time, three weeks after the operation, the nose was nicely healed.

REPORT OF A PATIENT WHO DEVELOPED HEMIPLEGIA FOLLOWING ANTRUM IRRIGATION. Presented by DR. JOHN A. CAVANAUGH.

A woman, aged 35, consulted me on Feb. 10, 1925. She had suffered with a cold in the head two weeks before, followed by a pain over the right side of the face and back of the head, with nasal discharge of pus from the right side. Dr. Otto Stein had washed out the right maxillary sinus two days before, with positive findings. The patient came to me to have the sinus washed again, as Dr. Stein had left the city.

A small pledget of cotton with three drops of 7 per cent. cocain solution without epinephrin chlorid was placed in the middle meatus over the hiatus semilunaris area and left on for about ten minutes. I removed it and tested the area, as she complained of it hurting, I introduced a cotton applicator with two drops of 7 per cent. cocain solution and let it remain again for about ten minutes. The patient was very nervous, yet controlled herself quite well. I then introduced a Pierce cannula into the lower part of the hiatus and it dropped into the cavity; not a drop of blood appeared; the head and body were bent forward; the adaptor of the continuous rubber bulb syringe (4 oz. size) was connected with the cannula and an iodin solution, 1:12 in sterile water, was used for irrigating. The nurse squeezing the bulb said it worked very hard and the patient complained of pressure. I judge about 4 drams of the solution returned from the sinus with some small globules of mucopus then stopped entirely. I removed the bulb and applied the adaptor on a four ounce rubber bag, squeezing the bulb carefully myself and the air with iodin solution came through without a complaint from the patient and

with but little pressure. I then re-applied the tip of the rubber irrigating bulb and as soon as the nurse started to force the solution into the sinus the patient cried out, "Oh, my eye," and with that threw her head and body back into the chair and her legs and feet outward. Thinking she was in a faint, I put her head forward and low; there was no rigidity, no apparent respiratory involvement and no cyanosis; a pallor similar to that of a fainting person was present; the pulse was thready and weak. Aromatic spirits of ammonia were held to the nostrils, she seemed to take a deep breath and the pulse improved. The pupils were not dilated and responded to light, there was no deviation and no nystagmus. She perspired profusely. We placed her on a couch and Dr. Orcutt tried to administer spiritus frumenti but was unable to get it into her throat as her jaws were closed. She was then given $\frac{1}{100}$ of a grain of nitroglycerin hypodermically. While on the couch her eyes converged mostly to the right but would occasionally roll to the other directions and she seemed to improve and respond to voices. About ten minutes after the nitroglycerin had been administered, she vomited a large quantity of undigested food, after which she again appeared to improve. She was moved from the office in an ambulance after some time, still unconscious. At the time I thought it was a case of hysteria.

DISCUSSION

Dr. Maurice Lewison said that this patient was first seen by him on February 10, at 5:00 p. m., with a history that while the antrum of Highmore was being irrigated a few hours before, she suddenly went into collapse and had been in that state ever since. She was completely unconscious, ghastly pale, and her expression was cadaveric. Vomiting was frequent. The eyes were open and staring, there was a conjugate deviation to the right, the right pupil was slightly larger than the left, and both pupils reacted to light. There was a complete quadriplegia and none of her members responded to pin pricks. The reflexes on the right side were exaggerated and Babinski's sign was present. On the left side the reflexes were decreased and at times the Babinski was also positive. A careful general physical examination revealed no abnormalities in the throat, heart, lungs, abdomen or genitals. The pulse was 110, temperature 97.6 F. and respiration 16. Kernig's sign was positive on both sides. The condition remained unchanged and the following evening after consultation with Dr. Olkon and Dr. Bassoe, neurologists, a spinal puncture was performed. The fluid came clear and at a normal rate. The patient's condition then became worse, and muscular twitchings developed in the left upper and lower extremities. These gradually increased and she soon developed general convulsive seizures, involving the left side of the face and the upper and lower extremities. Ocular deviation to the right was more marked during that period and retinal examination was negative. Dr. J. C. Beck saw the patient at this time and examined the antrum, which he found inflamed, and by suction drained a small amount of bloody fluid. At this time Dr. Frederick Tice and Dr. D. M. Trace also saw the patient, and they all agreed that she had developed a severe pathologic process in the brain. A hypodermic injection of morphin was administered, after which the convulsions gradually subsided and a few hours later had disappeared and the general condition of patient seemed slightly improved. She remained in about the same condition, being completely unconscious for about two weeks. During this time the temperature ranged between 100 and 101, pulse about 120 and respirations from 24 to 30. The motion in the right side of the body gradually

improved, but the Babinski sign remained positive on that side. The left arm and leg were completely paralyzed until about four weeks after the onset, at which time the motor condition gradually began to improve. Consciousness began to re-appear two weeks after the onset and gradually improved, until she became absolutely clear mentally. The patient was still very weak, but the motor power of the right side was perfect; that of the left side was still impaired, but was gradually improving. During the course of the disease, the patient developed a slight cystitis, due to catheterization and involuntary movements, and also a cellulitis of the thigh, due to many hypodermic injections of camphorated oil. He believed that this was an unusual case of multiple air embollae in the brain, due to the entrance of air in some of the veins of the maxillary sinus.

Dr. Joseph C. Beck said that he saw the patient about 1:00 a. m., and found her in a supine position, jerking about two to the minute. The right arm was bent, the right eye showed conjugate deviation and there was nystagmus to the right. He introduced a trocar through the inferior meatus and by means of Bier's pump withdrew a quantity of slightly blood-tinged fluid. He could not see that the antrum was inflamed, and the patient did not improve following this procedure. The following day, in company with Dr. Cavanaugh he saw her again. She then seemed to have improved somewhat. There was no change in the fundi, the pupils seemed to react quite well. He saw her two or three days later and at that time she seemed to respond by grunts when spoken to. In his opinion there was not enough air pressure used to account for the condition. The blood picture showed 35,000 leukocytes, which he considered evidence of an infection, probably thrombotic in character.

Dr. Stein said that when he saw the patient he passed a Pierce cannula without any difficulty whatever. The woman was hypersensitive and he examined her under thorough cocainization of the nostrils, using the endoscope, and thought he recognized pus coming from the sphenoid, but irrigation of the sphenoid revealed nothing. He then introduced the cannula into the antrum using a rubber bulb syringe, and being very careful not to introduce any air. The fluid entered the antrum and washed out an enormous amount of pus, following which the patient went home feeling relieved.

Dr. Michael Goldenburg (by invitation) said that he had a similar case in a woman patient, aged about 35 or 40, who consulted him because of difficulty with her eyes. Examination showed some blurring of the optic nerve head on one side. Transillumination of the sinus disclosed a shadow in the region of the antrum. A trocar was passed, a washing made, and just a small amount of air under pressure used. The woman dropped her head on her chest, there was a little quivering of the arms and legs. They thought it was an epileptic attack and gave some aromatic spirits of ammonia, but the patient did not respond. She was placed on the floor and artificial respiration was continued for an hour, but she never recovered. Their impression was that death had occurred because of the cocain. The case was made a coroner's case and necropsy revealed air embolism in the heart, in the coronary, cerebral and mesenteric arteries.

They believed the probabilities were that some granulation tissue was present in the antrum and by forcing in the air into the antrum the thin walled vessels were broken and the air distributed in that way. The patient was probably dead before they resorted to artificial respiration.

Dr. Alfred Lewy asked if Dr. Cavanaugh observed any edema of the eyelids immediately after washing out the antrum.

Dr. James E. Lebensohn said that the amount of air used was of immense importance. Grove, in his paper given before the Society two years ago, cited twenty deaths following the use of air in the antrum. In many of the cases reported, compressed air was used under high pressure. The immense amount of air and the speed with which it entered into the blood stream caused the immediate fatality. Where less air was used, alarming sequences followed but the patient generally escaped with his life. Dr. Lebensohn knew of a case where even the air in the tube connecting a Lichtwitz needle with a pint piston syringe was sufficient to cause a temporary hemiplegia, from which the patient completely recovered after a few hours. As to the pathology, Grove thought the needle separated the mucous membrane from the underlying bone, and that air was thus forced into the submucous venous plexus. When symptoms occur after irrigation of the antrum, and even a little air is used, this air must be considered as the most probable factor.

Dr. Norval H. Pierce said that he saw a patient with a sinus infection and pus from the ethmoid, who had had a pledget of cotton soaked in cocain placed in the middle meatus. She waited in an adjoining room until the cocain had time to penetrate; when she was called into the consultation room and attempted to walk she fell forward, apparently unconscious. Her husband was called, and he took her away after some little time, still semi-conscious. She remained in this condition for two days, and then gradually improved and recovered completely. In this case the antrum was not washed out, there was no instrumentation in any way, except that the pledget of cotton was placed in the middle meatus. She was a highly hysterical woman, with many peculiar mental quirks. In his opinion there are cases of grave functional disorder which might simulate such a picture even as that which occurred in this case of Dr. Cavanaugh's. Before concluding that the injection of just a small amount of air under the mucous membrane could produce so many pathologic conditions throughout the body, with paralysis of the leg and arm on one side and weakness on the other, without any respiratory or cardiac symptoms that would seem to be logically connected with an embolus, other possibilities should be considered.

Dr. George W. Boot said that as there are so many fatalities from washing out the antrum he thought it was time to change the method. In the case reported the patient was examined by two or three neurologists, who should be able to tell whether it was hysteria or not. It is so easy to open the middle meatus with a rasp and wait a day or two before washing out that he considered this much the better plan.

Dr. Cavanaugh (in closing) said that there was no disturbance or edema in any part of the eye at any time. In practically all of the cases in the literature there was a great deal of trauma, a needle puncture having been made, followed by bleeding. In this case the instrument used was a Pierce cannula, which dropped into the cavity. There was no trauma, no bleeding. The patient made no complaint until they started the water irrigation. Dr. Cavanaugh did not believe the condition was due to air.

Lung Abscess Following Safety Pin in Esophagus. Presented by Dr. John A. Cavanaugh.

A man, aged 22, Polish, employed at the steel mills, was sent to me on July 26, 1924, through the courtesy of Dr. Harry Parker of Gary, Ind.

The patient stated that he awoke about 4:00 a. m. on July 26, with a pain in his throat and thought that while he was asleep a big bug had crawled into

his mouth. He tried to wash it down with water, but the water came back. His mother then prepared ground crackers and hot coffee which also came back. After trying several other home remedies without relief, they consulted a doctor who had a private hospital in Gary. The doctor made a roentgen-ray examination and discovered the safety pin lodged in the esophagus. The patient was advised to take an anesthetic and have the foreign body pushed into the stomach, and removed by an operation. The patient went home and talked the situation over with his father and mother and decided to have this done. He returned to the doctor about 8:00 a. m., was anesthetized with ether and the doctor tried to push the pin into the stomach. After over an hour of this manipulation another roentgen-ray examination revealed the pin in the same location. The patient was then put back to bed, and when he had recovered from the effects of the anesthetic, he was told that they had failed to get the pin, but that they would try again that afternoon and remove it. He left this hospital and went to the Mercy Hospital at Gary, where another roentgen-ray examination was made, showing the safety pin. Dr. Parker was called and he advised them to get in touch with me. The patient was taken into St. Luke's Hospital, where I saw him about 9:00 o'clock that evening. He was sitting up in bed, had an anxious expression and was perspiring freely. He had a slight hacking cough, was spitting sputum streaked with blood, and it was difficult for him to talk as it pained him more and increased the frequency of the cough. When spoken to he would respond in a whispered voice. He could not lie down as it hurt him too much and also caused more severe coughing. The temperature was 100.6 F., pulse 112 and respiration 30. Roentgen-ray examination showed a large safety pin opened with the point and shield uppermost, located from about the center of the fourth cervical to the upper edge of the seventh cervical vertebra. The patient was given ¼ grain of morphin sulphate and $\frac{1}{150}$ grain of atropin. Examintion was made in the sitting position, as the patient was unable to lie down, and showed that the lips and gums were somewhat swollen, and the teeth were covered with sordes. There was a small abrasion back of the incisor teeth on the hard palate, probably the result of a mouth gag. The tongue was somewhat enlarged and coated. The pharynx was bluish, swollen and coated with a blood stained mucus. Depressing the tongue showed the epiglottis and aryepiglottic folds also swollen and bluish.

With a Jackson direct laryngoscope, I examined the larynx; the vocal cords showed considerable redness and the arytenoids were swollen, bluish and covered with a bloody mucus. The introitus into the esophagus had lost its normal appearance. No anesthetic was used. Having to talk to the patient through an interpreter made the work especially difficult. I introduced a Jackson 10 mm. esophagoscope, and experienced no trouble in entering the esophagus. The esophageal mucous membrane was edematous and the instrument looked as though it was in the center of an angiomatous field. I could not locate the foreign body, and when the tube was introduced between 19 and 20 cm. from the teeth line the patient became unruly and the tube had to be removed. I then decided to use the fluoroscope. As the patient could not lie on his back, I had to have him lie on his side, which was exceedingly awkward. I used the Jackson esophageal speculum and when my assistant told me that the end of the instrument was at the shield end of the pin, I carefully pushed aside the swollen tissue with a heavy alligator forceps and finally spied the straight part of the pin between the shield and the spring. I grasped it and gently pushed the pin downward a little when the point came into view. I

was then able to get the end of the speculum under the point and then gradually withdrew the pin on the speculum and removed it in this position. The patient was then put to bed and could now lie down. Rectal feeding was ordered. The following day the temperature ranged from 99.6 to 100.4 F.

On July 28, the temperature ranged from 98 to 99.6 F., and the patient refused rectal feeding. He was then given bismuth subnitrate and calomel as suggested by Dr. Jackson. Chest examination was negative.

On August 2, he was taken home as he refused all medicine and the nurses could not control him. Chest examinations were again made and found negative.

I heard nothing more from him until he returned to St. Luke's Hospital three months later under Dr. Arthur R. Elliott's service, complaining of cough, fever in the evenings, night sweats and weakness. When he was admitted to the hospital the temperature was 99 F., pulse 108 and respirations 28; the blood pressure systolic 110 and diastolic 70. The patient stated that three weeks before coming to the hospital there was a sudden gush of very foul smelling matter up into his mouth. None had appeared since, but he had coughed up a greenish pus daily. Examination showed that the chest was symmetrical; the excursion was good on the left side. The right side lagged and was shallow. On percussion, there were no areas of dulness anteriorly. An area about 2 inches (5 cm.) square was noted at the base of the right lung just to the right of the spine. On auscultation there was an absence of breath sounds over the area of dulness, and an area of hyper-resonance and loud sonorous râles up to the lower angle of the scapula. Blood examination revealed a leukocyte count of 14,600; hemoglobin 75 per cent.

The roentgen-ray examination showed a circumscribed mass involving the lower right half of the chest. The mass extended outward to the mid-clavicular and upward to the third rib anteriorly. A diagnosis of lung abscess was made.

Treatment by gravity was tried. A roentgen-ray examination about three weeks later, showed a mass in the same position but the density was much less and a thick capsule was seen. As this procedure wrought no perceptible improvement, the patient was transferred to the surgical side under the care of Dr. Albert E. Halstead on December 16. Daily sputum examinations for tubercle bacilli were negative.

On December 22, Dr. Halstead resected 2 inches from the ninth and tenth ribs on the right side close to the spine, exposing the posterior mediastinum. There was no adhesion between the visceral and the parietal pleura, and the abscess cavity could not definitely be located. Packing was introduced to cause an adhesion of the parietal and visceral pleura. A ring was placed at one point to determine the relation of the abscess to the area packed, and roentgen-ray examination showed the ring at the lower and external part of the dense mass. A week after the resection of the ribs, an incision was made at the ring site into the supposed abscess; no pus was found, but necrotic lung tissue, of a very foul odor. Dr. Halstead removed this necrotic tissue and then packed with tincture of benzoin on gauze. Following this the patient gradually improved. A roentgen-ray examination on Jan. 20, 1925, showed the dense area no longer sharply defined and considerably cleared. The patient left St. Luke's Hospital, Feb. 10, 1925 and is now back at his work in the steel mills.

DISCUSSION

Dr. Edwin McGinnis thought that the roentgen-ray examination made foreign bodies look easy to remove. He congratulated Dr. Cavanaugh on getting

the pin out without any additional trauma, and on the happy result of the case. He asked if any bacterial examination of the expectorated material was made.

Dr. Cavanaugh replied that both a fusiform bacillus and a spirochete were found.

Dr. McGinnis stated that he had recently reviewed the findings in similar cases and there was usually great difficulty in securing a satisfactory external drainage. In one case the surgeon made two or three attempts to get the tube into the abscess cavity, and when the tube was in place little pus drained out. In view of the work that had been done, he thought the best way to drain such abscesses was through the trachea, by means of a bronchoscope.

The intravenous injection of neo-arsphenamin has also been of benefit in these cases. He had a similar case under treatment, except that the foreign body was a blood clot in the bronchus.

Dr. George W. Boot thought there was nothing more difficult than removing open safety pins from the esophagus. He has had four bronchoscopic deaths, two of which were due to safety pins. In an infant, seen recently, the pin was accidentally touched with the tube used for removing the saliva, and dislodged. The procedure was stopped and the physician said they would do nothing until the next day. By the following day the child had passed the safety pin with the stool. The ring end is sure to pass first, and does not produce much trauma.

The youngest patient from whom he ever had to remove a safety pin was an infant, aged 11 days, who swallowed an open safety pin. Roentgen-ray examination showed the pin open to a right angle. Dr. Boot pushed the esophagoscope down over the pin and removed it by drawing the pin into the tube and straightening it.

Dr. Boot presented roentgenograms of several other infants who had swallowed safety pins, and one who had swallow a cork.

He said Dr. Cavanaugh did not mention the relation between the lung abscess and the safety pin in the esophagus. Dr. Boot did not believe there was any relation, except that the young man had received two anesthetics before Dr. Cavanaugh saw him, and that the abscess was due to inhalation while under too deep an anesthetic. He did not think the safety pin itself had anything to do with the occurrence of the abscess.

Dr. Frank Novak, Jr., asked what was the relation of the site of the safety pin to the site of the abscess.

Dr. Cavanaugh (in closing) said, in reply to Dr. McGinnis, that probably a bronchoscopic examination immediately would have been a good thing, but as the case turned out he doubted if it would have resulted in any benefit. The patient was given three doses of neo-arsphenamin at different times following the operation.

Replying to Dr. Novak, he said that so far as he could see there was no relation between the location of the pin and the formation of the abscess. There was nothing in the roentgenogram which showed any connection.

Dr. Cavanaugh agreed with Dr. Boot that the abscess was probably due to the inhalation of some foreign material during the ether anesthesia.

Insulin in Diabetes with Mastoiditis. Presented by Dr. T. C. Galloway (entrance thesis).

The changed attitude toward operative relief of infections in diabetes mellitus was pointed out, as well as the much greater assurance of their

proper surgical relief, due to advances in treatment, especially with insulin.

A case of mastoiditis was reported with only doubtful glycosuria, but with a blood sugar of 0.308 per cent. A simple mastoidectomy was followed by erysipelas; there was absolute failure of wound repair for eighteen days and the symptoms suggested meningeal irritation. When blood sugar determination was made, the diagnosis of diabetes was clear, the symptoms readily responded to diet and insulin with complete though slow healing. A coincident nephritis was suggested as the cause of the high kidney threshold for sugar.

The procedures were outlined for otologic cases in mastoiditis, and the time and indication for operation, the preoperative preparation, and the choice of anesthetic were considered. The importance of removing the overload of infection on the diabetic organism, and of treating foci of infection was stressed. The great improvement in statistics in diabetes was cited and the conclusion drawn that proper surgical intervention could be undertaken in relative security.

DISCUSSION

Dr. Cavanaugh and Dr. Pierce congratulated Dr. Galloway on his presentation.

Dr. George W. Boot thought that the infection by *Streptococcus hemolyticus* was very important, and considers this one of the causes of diabetes. In two cases of scarlet fever which he had seen, the patients developed diabetes as the result of *Streptococcus hemolyticus* infection.